DistanceLearningCentre.com

STUDENT ASSESSMENT - TAQS

COURSE:	**Access to Higher Education Diploma**
SUBJECT:	**Chemistry / Medicine**
UNIT TITLE:	**Applied Biochemistry**
LEVEL:	**3 (Graded)**
CREDITS:	**6**

This document contains your tutor assessed questions (TAQs) for this assessment.

Do not attempt to fill in this document. Please use the related Student Assessment Answer Sheet to answer your TAQs.

COURSE RESOURCES:

You will need to be logged in to your Learner Account to access these resources

We advise that you check the **Ascentis Subject Set Unit Specifications – Applied Biochemistry** for the 'indicative content' of the unit, as this may help you to understand how you could meet specific assessment criteria.

Student Handbook

Log in to your **Learner Account** and click on **'Library'** to view various resources to help you with your learning.

Study Skills - How to make sure your work is 'Ready for Marking'

PODCAST:

The podcast for this assessment is essential reading / listening in order to complete this unit and succeed on the assessment. Please use it fully.

Applied Biochemistry Assessment Podcast

You can find the Podcast transcript in the Appendix at the end of this document

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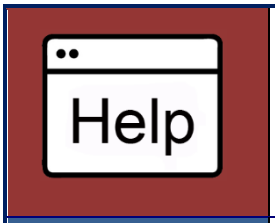
Assessment Criteria



HELP AND GUIDANCE:

Read through all the instructions on this document and the *Student Assessment Answer Sheet* before you begin to work on your assessment.

AIMS AND OBJECTIVES:

The aims and objectives of this assessment is for you to demonstrate that you know and understand:

- **the terms 'anabolic' and 'catabolic' reactions, providing named examples.**
- **the structure and functions of enzymes.**
- **a range of factors influencing enzyme activity (including data interpretation).**
- **the applications of genetic engineering techniques.**

Below are the assessment criteria for this unit. When you have met the assessment criteria for the unit your work is eligible for the Grading Standards to be applied. There is no Grading Standard for 'Pass' as this is achieved by meeting the requirements of all the unit's assessment criteria.

Further guidance on the Grading Standards and how to achieve Merits and Distinctions can be found at the end of this document.

LEARNING OUTCOMES (LOs) The student should be able to:		ASSESSMENT CRITERIA (ACs) The student has achieved the learning outcomes because they can:	
1	Demonstrate an understanding of anabolic and catabolic reactions	**1.1**	Define anabolic and catabolic reactions
		1.2	Distinguish between hydrolysis and condensation reactions
		1.3	Describe the use of chemical reagents to investigate hydrolysis and condensation reactions
2	Demonstrate an understanding of enzyme structure and function	**2.1**	Relate the structure of an enzyme to its biological function
		2.2	Discuss the effects of competitive and non-competitive inhibition on the catalytic function of an enzyme
3	Interpret data related to factors affecting enzyme activity	**3.1**	Discuss the effect of temperature and pH on the catalytic function of an enzyme
4	Demonstrate an understanding of medical	**4.1**	Explain a medical application for the use of bacterial plasmids in the production of recombinant genetic material

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	applications within modern genetic engineering techniques	**4.2**	Describe the use of polymerase chain reaction (PCR) and gel electrophoresis in DNA profiling

Tutor Assessed Questions (TAQs)

TAQ 1:

Assessment criterion 1.1, 1.2, 1.3

Part 1

i) **Define** the term **'anabolic reaction'** and **explain** why the formation of **glycogen** is a good example of this type of reaction.

ii) **Define** the term **'catabolic reaction'** and **explain** why the formation of **glucose molecules** from a **polysaccharide** such as **glycogen** is a good example of this type of reaction.

Part 2 a:

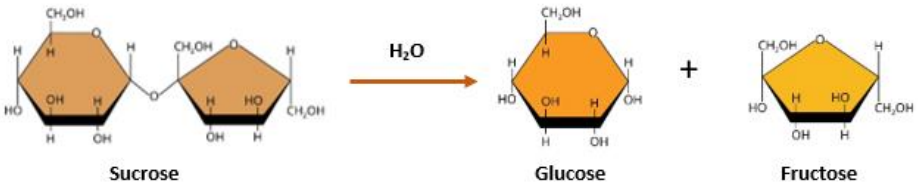
i) With reference to the **two** metabolic processes (**A** & **B**) that are presented as displayed formula below, identify which one indicates a **hydrolysis** reaction has taken place, and use evidence in the reaction illustration to support your choice.

ii) Is this an example of an anabolic reaction or a catabolic reaction?

iii) Which of the displayed formula (**A** or **B**) indicates that a **condensation** reaction has occurred? Use evidence in the reaction illustration to support your choice.

iv) Is this an example of an anabolic reaction or a catabolic reaction?

Reaction A



Sucrose Glucose Fructose

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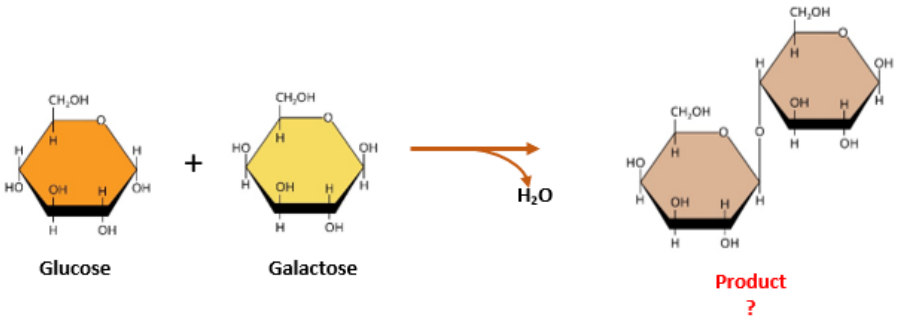
Reaction B



Part 2 b:

A Science student decided to carry out a Biochemical test investigation. The student predicted that mixing glucose and galactose with an enzyme (and then incubating the reactant solution in optimal conditions) would produce a non-reducing sugar as a product.

The student used a specific biochemical reagent and followed a reliable method step by step. Upon completion of the test the student recorded the following results:

Solution	Reagent:	
	Colour before heating	Colour after heating
Mixture of glucose and galactose with no enzyme	Blue	Brick Red
Mixture of glucose and galactose with an enzyme	Blue	Brick Red

Table 1: Reaction between glucose and galactose

i) What **Biochemical reagent** must the student have used to get the results shown in Table 1, and **explain** why?

ii) Why was the student wrong to predict that the product of this reaction would be a non-reducing sugar, based on the test results recorded?

iii) What is the **name** of the **product** that was formed in the student's test?

After doing some further reading, the student realised that fructose should have been mixed with glucose instead of galactose (and a different enzyme used). The test was therefore repeated, and the same prediction was made (that the product would be a non-reducing sugar).

iv) **Complete** the third column in **Table 2** to show the results that the student would have recorded.

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Solution	Reagent:	
	Colour before heating	Colour after heating
Mixture of glucose and fructose with no enzyme	Blue	
Mixture of glucose and fructose with an enzyme	Blue	

Table 2: Reaction between glucose and fructose

v) Was the student's prediction for the new test accurate?

Explain your answer.

Part 3 a:

i) When two amino acids are bonded together a dipeptide is formed.

Using full displayed formula **illustrate** how a dipeptide is formed from two individual amino acids (each with no assigned R groups).

ii) **State** whether this is a condensation reaction or a hydrolysis reaction and use evidence in the illustration to support your answer.

Part 3 b:

Another Science student decided to carry out a Biochemical test investigation. The student predicted that mixing a protease enzyme with a solution containing albumin (a blood protein) and then incubating the reactant solution in optimal conditions, would create amino acids and that this would produce a negative Biuret test result

Upon completion of the test the student recorded the following results:

Solution	Reagent: Biuret Solution	
	Colour Change (From)	Colour Change (To)
Albumin in solution with no enzyme	Light Blue	Violet
Albumin in solution with protease enzyme	Light Blue	Violet

Table 3: Biuret test results

i) What do the results in **Table 3** reveal about the composition of the two solutions?

ii) What type of reaction (condensation or hydrolysis) would have taken place when albumin was incubated with the protease enzyme?

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iii) Would you expect a solution where protein has been completely converted to amino acids to show a positive Biuret test result? **Explain** your answer.

iv) Why is it that the solution containing albumin and protease turned violet when treated with Biuret solution?

WORD COUNT:

Part 1 – 150 words

Part 2 – 200 words

Part 3 – 150 words

Total word count = 500

HELP AND GUIDANCE:

For Part 1- It is important that you define an 'anabolic reaction' and a 'catabolic reaction' fully, to include the link between bonding and energy gain / release.

For Part 2 a)- It is not enough just to state your answers as either 'A' or 'B'. Some justification is expected (using evidence in the illustrated reactions).

Remember that in this TAQ you have to demonstrate that you understand the difference between the terms 'anabolic' and 'catabolic,' as well as the terms 'condensation reaction' and 'hydrolysis reaction' (using examples) to meet the demands of **AC 1.1** and **1.2** respectively.

Part 2 b) and **part 3** are scenario-based and so be sure to read these carefully before attempting the related questions. Here you are being assessed on your understanding of different biochemical tests to identify two classes of biomolecules and so you should revisit **section 2.4** of the unit materials in preparation.

For part 3 a) you are expected to produce a drawing of how a dipeptide is formed from a reaction between two amino acids. You are asked to present the components of the reaction as full displayed formula. This means that you must show all atoms and bonds between atoms. Labelling the components of this reaction is also important.

TAQ 2:

Assessment criterion 2.1, 2.2

Part 1a: The **catalytic** function of an enzyme is based on its structural architecture.

Explain how the structural features of an enzyme allow it to carry out this function. You should focus on the following points in your account:

- tertiary structure (and shape),
- stabilising bonds,

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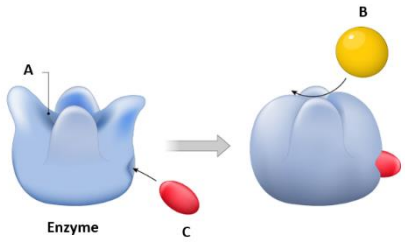
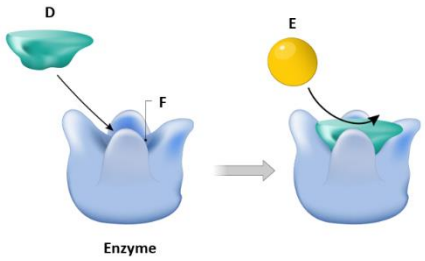
- active site,
- substrate specificity,
- activation energy,
- rate of a reaction.

Part 1b: The enzymes maltase and sucrase have similar structural features, and they are both involved in the chemical digestion of disaccharides. With reference to the induced fit model of catalysis, **explain** why maltase is able to catalyse the breakdown of the disaccharide maltose but not sucrose.

Part 2: Competitive and **non-competitive** Inhibition influences the rate of enzyme-catalysed reactions. These two forms of inhibition are illustrated below as **Type 1** and **Type 2**.

Enzyme Inhibition Type 1	Enzyme Inhibition Type 2
	

i) **Name** the type of inhibitions shown in these illustrations.

Type 1 =
Type 2 =

ii) **Label** the following components shown in the two illustrations:

A and **F =**
B and **E =**
C =
D =

iii) With reference to the labelled components, **discuss** the effect that inhibition **Type 1** has on the catalytic function of an enzyme.

iv) With reference to the labelled components, **discuss** the effect that inhibition **Type 2** has on the catalytic function of an enzyme.

v) With one of these types of inhibition, increasing the concentration of the enzyme's substrate will increase the likelihood that a catalytic reaction will take place.

Identify which type of inhibition this statement relates to and **explain** your answer.

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WORD COUNT:

Part 1 – 250 words

Part 2 – 200 words

Total word count = 450

HELP AND GUIDANCE:

For **part 1 a)** you are expected to **relate** the **structure** of an enzyme to its biological **function** as a catalyst. Therefore, visit the DistanceLearningcentre.com tutorial which focuses on what relating structure to function entails by clicking on the link below.

Make sure that you consider all of the bullet points listed in the question because these have been included to guide you in the right direction.

In Part 1 b) you need to outline the principles of the induced-fit model for enzyme catalysis (with reference to the action of maltase specifically). Be sure to revisit **section 3.1** of the unit materials to ensure that you are using the correct terminology. This section of the materials also covers enzyme specificity, which is a component of the question. You are encouraged to include a labelled diagram to illustrate induced fit, but this must be referred to directly in your written account. Try designing the diagram to show the induced-fit model for maltase specifically.

For **part 2:** you need to discuss the effect that **both** competitive and non-competitive inhibitors have on the ability of enzymes to catalyse a reaction. Be sure to make full use of the diagrams displayed in the question because by describing what is happening in each diagram, you will automatically be describing the two forms of inhibition.

COURSE RESOURCES:

You will need to be logged in to your Learner Account to access these resources:

Linking Structure to Function

TAQ 3:

Assessment criterion 3.1

Part 1:

Table 4 below displays the processed data obtained when a science student carried out an experiment to determine the effect of different temperatures on the rate at which an enzyme is able to catalyse a hydrolysis reaction.

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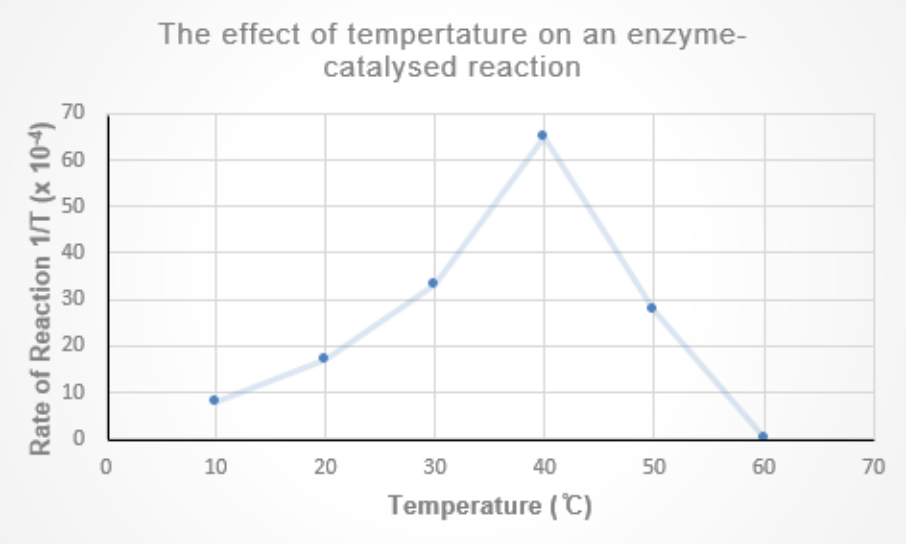
	Temperature (°C)					
	10	**20**	**30**	**40**	**50**	**60**
Rate of reaction 1/T sec^{-1} (x10^{-4})	**8**	**17**	**33**	**65**	**27**	**0**

Table 4: Results of an experiment investigating the effect of temperature on enzyme activity.

The student then created a line graph (shown as **Graph 1** below) to better observe a trend in the data.



Graph 1: Plotted data on enzyme activity

a) With direct reference to data in **Table 4**, and the trend shown in the plotted graph, **explain** the effect that a range of temperatures has had on the catalytic activity of the enzyme used in the investigation.

You are expected to refer to specific data values and support your explanation with scientific theory.

b) Using the rate of reaction values in **Table 4,** calculate the Temperature coefficient (Q_{10}) at the following temperatures;

i) **T°C = 10°C**

ii) **T°C = 30°C**

iii) **T°C = 40°C**

c) Applying your understanding of the concept of Q_{10}, provide an explanation for the Q_{10} value calculated in **part ii)** and **part iii)**.

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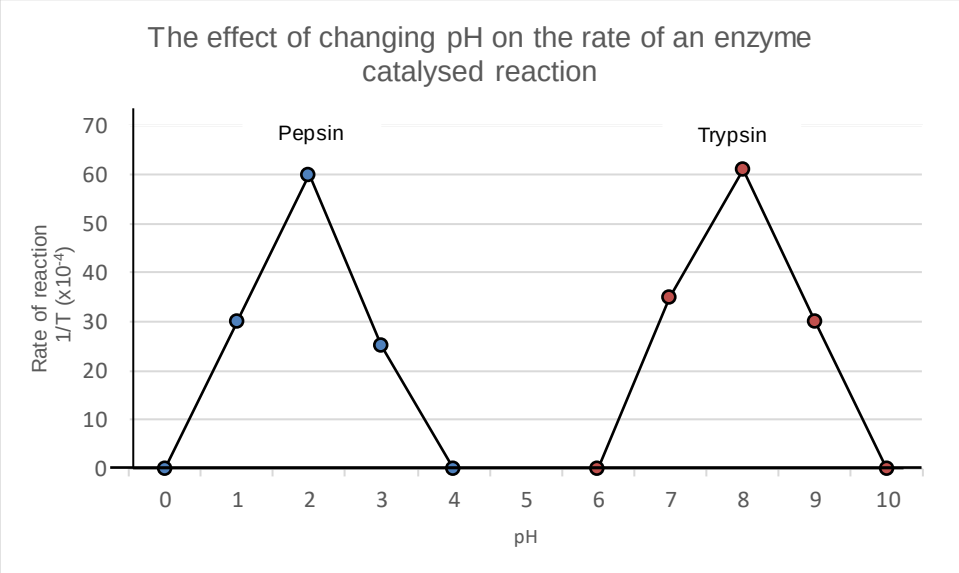
Part 2:

Table 5 below displays the processed data obtained when a science student carried out an experiment to determine the effect of pH on the rate at which the enzymes **pepsin** and **trypsin** catalyse specific reactions.

		pH										
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Rate of reaction **1/T sec^{-1}** (x10^{-4})	Pepsin	0	30	60	25	0	0	0	0	0	0	0
	Trypsin	0	0	0	0	0	0	0	35	61	30	0

Table 5: Results of an experiment investigating the effect of pH on the catalytic activity of pepsin and trypsin.

The student then created a line graph (shown as **Graph 3** below) to better observe a trend in the data.



Graph 3: Plotted data on pepsin and trypsin activity

a) With direct reference to data in **Table 5**, and the trend shown in the plotted graph, **explain** the effect that pH has had on the catalytic activity of the two enzymes used in the investigation.

You are expected to refer to specific data values and support your explanation with scientific theory.

b) Based on the two graphs, **explain** why pepsin would not be able to catalyse the hydrolysis of polypeptides once it has exited the stomach (mixed with partially digested food) and enters the duodenum (first section of the small intestine).

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WORD COUNT:

Part 1 a) – 300 words
Part 1 c) – 100 words
Part 2 a) – 250 words
Part 2 b) – 50 words

Total word count - 700

HELP AND GUIDANCE:

For **part 1 a)** you are instructed to discuss the effects of temperature on enzyme activity using the tabulated data and accompanying line graph. To produce an **effective discussion**, you must link data to Scientific theory. Just describing the effect that temperature has on enzyme catalysis (pure theory) is not enough. You must refer to data values and trends shown in the graph and back this up with theory. Visit **section 3.5** of the materials to recap underpinning theory on factors that influence enzyme activity. Consideration should be given to the link between temperature, Kinetic energy, and collisions between an enzyme and its substrate, as well as enzyme denaturation.

For part 1 b)- You need to make use of the equation covered on **page 32** of the course materials when calculating Q_{10} at the three stipulated temperatures (T°C). You must also show the method by which you arrived at each Q_{10} value.

In **part 1c)** you are expected to interpret what the calculated Q_{10} values indicate has happened to the rate of the enzyme-catalysed reaction (with a 10°C rise in temperature). Therefore, here you are applying the principles of the concept of Q_{10}.

For part 2 a) you need to take a similar approach but in this section, the focus is on the effect of pH on enzyme activity. Again, as this question asks you to discuss, you must refer to data values and use theory to explain this data.

TAQ 4:

Assessment criterion 4.1, 4.2;

Part 1: Recombinant DNA technology has revolutionised modern-day Science and the treatment of a range of medical conditions. It has made it possible to synthesise Human proteins in a laboratory. One such protein is insulin (an important hormone that is needed to regulate blood glucose concentrations). Once produced, this synthetic hormone is then prescribed to treat Type 1 Diabetes.

a) **Complete** the Table below by **summarising** the role of different enzymes in the process of producing **synthetic** insulin using recombinant DNA technology:

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Enzyme	Function in recombinant DNA technology to create synthetic insulin
Restriction Endonuclease	
Reverse Transcriptase	
DNA Ligase	
Alkaline Phosphatase	

b) **pBR322** is a plasmid that is commonly used in the process of creating synthetic proteins because of its antibiotic resistance genes.

With reference to this plasmid specifically, **explain** how the process of **replica plating** can be used to isolate only transformed bacteria that have taken up recombinant plasmids that contain the insulin gene.

c) Briefly explain how a commercial scale fermenter is used to yield synthetic insulin from transformed bacteria that have taken up the recombinant plasmid, once they have been isolated.

Part 2: Polymerase Chain Reaction (PCR) and **Gel Electrophoresis** are two techniques that are commonly used in Forensic analysis to identify from a set of suspects, who has committed a crime. The diagram below shows the results of Southern blotting for what started as a trace sample of DNA taken from a crime scene, as well as DNA taken from 3 suspects.

Figure.1 X-ray film showing the Results of Southern Blotting

a) **Explain** how **PCR** would have been used to ensure that the trace sample of DNA discovered at a crime scene was able to be used to create the clear bands evident in the Southern blot.

As part of your answer, you should describe the steps involved in PCR to include the role of named enzymes and changes in temperature.

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b) The results of the PCR reaction, along with DNA samples taken from three suspects were loaded onto agarose gel to undergo **Gel Electrophoresis.** Describe the principles of this technique.

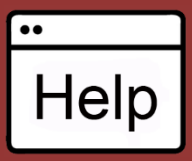
As part of your answer, you should outline the method used to produce bands of DNA, as well as to create a Southern blot x-ray film.

c) By analysing the Southern blot x-ray film (**Figure.1**) which of the three suspects would be charged with committing the crime?

Briefly **explain** your answer.

WORD COUNT:

Part 1a – 300 words
Part 1b – 200 words
Part 1c – 50 words
Part 2 – 300 words
Total word count = 850



HELP AND GUIDANCE:

Part 1- You are required to discuss in detail the role of named enzymes that are utilised in specific stages of recombinant DNA technology. While three of the listed enzymes are covered in the learning materials, the function of one enzyme will need to be obtained from wider reading.

Be sure to refer to the insulin gene / protein where necessary because **AC 4.1** demands that you explain a medical application. The same applies to the account on replica plating and use of a fermenter.

Part 2 is a scenario-based question that assesses your understanding of the application of PCR and gel electrophoresis in DNA profiling. However, the principles of these two techniques is an important aspect of your answer.

In this TAQ there is plenty of opportunity to make use of supporting labelled diagrams, but please keep in mind that to be of any benefit any diagrams that you include need to be assigned a figure number and title, and they also need to be referred to in your written work.

FURTHER RESOURCES:

	**Genetic Modification Explained || Insulin-Producing Bacteria**
	**How do Antibiotic Resistance Genes function as selectable marker or helps in transformant selection?**

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COURSE RESOURCES:

Make sure that your work is presented, referenced and submitted as per in the 'Ready for Marking' guide:

Reducing File Size

IMPORTANT INFORMATION:

Grading Standards:

Read the Grading Standards in the next section of this document to help you achieve a Merit or Distinction.

Submission deadline:

If you need an extension to the given deadline, request this via your tutor. This will always be granted.

If you do not ask for an extension and your work is late then you will need to complete an extenuating circumstances form. A copy of this is found on the policies page.

If you do not ask for an extension, or you have not filled out an extenuating circumstances form, then the highest grade you can achieve at this point is a Pass.

Acknowledging sources of information in a bibliography:

The **purpose** of the bibliography is to supply the information needed to allow your tutor to find the literature sources that you have made use of to develop your understanding of facts, concept, and principles.

Therefore:

1. A good approach when it comes to acknowledging sources for a completed unit assessment in science is to compile a bibliography **after each TAQ**.
2. Your bibliography should follow the **Harvard system**. For help on how to structure and organise your list of sources see: https://www.mybib.com/tools/harvard-referencing-generator
3. In-text referencing within your TAQ responses is **not required**.

COURSE RESOURCES:

Make sure that your work is presented, referenced and submitted as per in the 'Ready for Marking' guide:

Study Skills - How to make sure your work is 'Ready for Marking'

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Grading Standards for Merit and Distinction

When you have met the assessment criteria for the unit your work is eligible for the Grading Standards to be applied. There is no Grading Standard for 'Pass' as this is achieved by meeting the requirements of all the unit's assessment criteria. The Grading Standards for Merit and Distinction are as follows:

Grading Standard 1: Knowledge and understanding

MERIT:	**DISTINCTION:**
The student's work, or performance: a. **generally** demonstrates the ability to apply knowledge appropriately in a given context showing breadth **OR** depth of knowledge in responding to the demands of the unit, with b. a **very good** understanding and use of: • **facts** • **concepts** • **principles** • **procedures**	The student's work, or performance: a. **consistently** demonstrates the ability to apply knowledge appropriately in a given context showing breadth **OR** depth of knowledge in responding to the demands of the unit, with b. an **excellent** understanding and use of: • **facts** • **concepts** • **principles** • **procedures**
Extra guidance (this is not exhaustive):	
You **generally** show accurate **knowledge** and **understanding** of the assessment criteria and therefore the subject and unit you are studying, but there may be some errors or omissions in this. **Generally** means *in most cases* and would indicate a **very good** level of understanding.	You **consistently** show accurate **knowledge** and **understanding** of the assessment criteria and therefore the subject and unit you are studying, with only minor errors or omissions, if any. **Consistently** means *all, or almost all, of the time* and would indicate an **excellent** level of understanding.
You **generally** select **appropriate information** to demonstrate your understanding of **facts, concepts, principles,** and **procedures** and have sometimes applied this to the questions in the assessment. At this level, your answers may be more of a general response.	You **consistently** select **appropriate information** to demonstrate your understanding of **facts, concepts, principles,** and **procedures** and have often applied this to the questions in the assessment very well. Your answers will be closely related to the questions or any context you are given, demonstrating a strong application of knowledge and understanding in specifically tailored responses.
You show **very good** levels of **breadth** or **depth** as required by the questions.	You show **excellent** levels of **breadth** or **depth** as required by the questions.

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Grading Standard 2: Subject-specific skills

MERIT:	DISTINCTION:
The student, student's work, or performance: a. **generally** demonstrates an ability in selecting and using skills as required by the unit, with b. a **very good** understanding and use of: • **accuracy** • **interpretation**	The student, student's work, or performance: a. **consistently** demonstrates an ability in selecting and using skills as required by the unit, with b. an **excellent** understanding and use of: • **accuracy** • **interpretation**
Extra guidance (this is not exhaustive):	
Skills required by each unit are given to you as part of the assessment criteria Take careful note of the command words in the assessment criteria - words such as *describe, discus, analyse explain or relate*. Make sure you are applying the relevant information to your answers to address these skills. **Accuracy** relates to how well you show the right skill at the right time and how precise you are in demonstrating this skill. **Interpretation** relates to explaining and showing understanding of concepts.	
You **generally** show **skills** required by the assessment **accurately**, but this may not be consistent. For instance, you may be overly descriptive when asked to explain or you might not always relate structural features to properties. This would indicate a **very good** level of **accuracy** in the application of skills.	You **consistently** show **skills** required by the assessment **accurately**. For instance, when asked to explain or relate structural features to properties, your response will focus on this. This would indicate an **excellent** level of **accuracy** in the application of skills.
There may be errors in equations or calculations required in the unit.	Equations or calculations would have few (if any) minor errors.
You will show **very good interpretation** by giving accounts and explanations that are **generally** coherent and logical but could be clearer.	You will show **excellent interpretation** by giving accounts and explanations that are **consistently** coherent, logical, and clear.
Use of information is a subject-specific skill You will show **accuracy** and **interpretation** when you assess the relevance, importance, reliability and validity of the sources you have used in your research and writing.	
You will use of a range of sources to advance explanations to a **very good** standard.	You will use of a wide range of academic sources to advance explanations to an **excellent** standard.

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Grading Standard 3: Transferable skills

MERIT:	DISTINCTION:
The student, student's work, or performance: a. demonstrates **very good** communication and/or presentation skills evidenced by the use of: • **format** • **structure** • **grammar** • **number** b. demonstrates autonomy and/or independence evidenced by a **very good** ability to: • **plan, organise and complete work** • **conduct independent research** c. **generally** adheres to academic and/or professional conventions in use of technical/specialist language and/or format in responding to the instructions set out in the assignment.	The student, student's work, or performance: a. demonstrates **excellent** communication and/or presentation skills evidenced by the use of: • **format** • **structure** • **grammar** • **number** b. demonstrates autonomy and/or independence evidenced by an **excellent** ability to: • **plan, organise and complete work** • **conduct independent research** c. **consistently** adheres to academic and/or professional conventions in use of technical/specialist language and/or format in responding to the instructions set out in the assignment.
Extra guidance (this is not exhaustive):	
Your communication and presentational skills are assessed through the **formatting** and **language choices** you make, as well as how you **write** and **organise** your work. **Format** relates to choices you have made about the presentational style and language choices used in your work. The format of the work will influence the style and tone of your writing. **Structure** relates to the flow of the work and whether it makes sense and is logical. It is about how is the work is organised and how the parts fit together to form a whole response. **Grammar** is about the tone, style and construction of your written response. The clarity of your writing and the rules of written English will be considered here.	
You **generally** make appropriate decisions about how to present and format your work. This means that your work **generally** meets academic and/or professional conventions and that your language choices are **generally** appropriate for the demands of the assignment.	You **consistently** make appropriate decisions about how to present and format your work. This means that your work **consistently** meets academic and/or professional conventions and that your language choices are **consistently** appropriate for the demands of the assignment.
Your work will be **generally** written with an academic tone and style that conveys the right level of formality.	Your work will be **consistently** written with an academic tone and style that conveys the right level of formality.
Your work will be **generally** well structured to suit the purpose of the assessment. There may be times where a more effective and appropriate structure would	Your work will be **consistently** well structured to suit the purpose of the assessment. Flow, coherence and understanding are facilitated by an effective and appropriate structure.

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improve flow, coherence or the way understanding is demonstrated.	
You use technical and/or specialist language that **generally** adheres to academic and/or professional conventions.	You use technical and/or specialist language that **consistently** adheres to academic and/or professional conventions.
Referencing **generally** follows the Harvard referencing system, but there may be some inconsistencies.	Referencing **consistently** follows the Harvard referencing system with only minor inconsistencies, if any.

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Appendix- Podcast Transcript

TAQ.1

For Part 1- It is important that you define an 'anabolic reaction' and a 'catabolic reaction' fully, to include the link between bonding and energy gain / release. With each definition you also need to give a brief explanation for the examples referred to.

For Part 2 a)- You need to **identify** and then **document** the evidence presented in each diagram, to prove that either (A or B) is illustrating a hydrolysis reaction, and that either (A or B) is illustrating a condensation reaction. It is not enough just to state your answers as either 'A' or 'B'. Some justification is expected. As well as identifying the reactions displayed as either being hydrolysis or condensation, in **parts ii)** and **iv),** you also need to state if the reaction is anabolic or catabolic. However, you are not expected to justify this.

For part 2 b)- You are presented with a scenario and so it is important that you read through this carefully before answering the related questions. This scenario focuses on biochemical tests, and it is linked to the reactions in **part a)**. For **i)** you need to identify from the test that the student carried out, what chemical reagent has been used. You also need explain your answer based on evidence in the scenario and results shown in Table 1.

For **ii)** you need to use the results of the biochemical test to explain why the student's prediction was incorrect. For **iii)** you simply need to state the product of the reaction. This can also be determined by looking at reaction B in **Part 2 a)**. There is an extension to the scenario that you then need to read, and based on this information, for **iv)** you will need to apply your understanding of biochemical tests to determine the colour change for the two solutions. Finally for **v)** you will need to state if (or if not) the student's new prediction is accurate. You also need to explain your response.

For part 3 a) you are expected to produce a drawing of how a dipeptide is formed from a reaction between two amino acids. You are asked to present the components of the drawing as full displayed formula. This means that you must show all atoms and bonds between atoms. You are told that the two amino acids have no assigned R groups and so the species attached (via a bond) above the central carbon can be stated simply as R. You should label the diagram to include an arrow pointing to the bond formed, and the name of this bond should be stated. In part ii) you need to state if the diagram is indicative of a hydrolysis reaction or a condensation reaction.

For part 3 b) you are presented with a new scenario relating to a student's experiment on the use of biuret solution to determine if mixing protein with a protease enzyme will create amino acids that will not show a positive colour change. For **i)** you are asked to interpret the results of the biochemical test in terms of identifying the composition of the two solutions. To again, check your understanding of condensation versus hydrolysis reactions, for **ii)** you will need to state which of these types of reaction will have taken place. For **iii)** you are asked to evaluate the outcome of the biochemical test based on your understanding of how biuret solution behaves when mixed with proteins compared to individual amino acids. The final part of this TAQ is potentially challenging because you are expected to think outside the box.

TAQ.2

For **part 1 a)** you are expected to **relate** the structure of an enzyme to its function as a biological catalyst. This is quite a demanding question because you have to describe the tertiary structure of an enzyme (covering the first three bullet points) and then make links to function (covering the second three bullet points). A key consideration that must be included in your account is the active site of an enzyme, and the concept of activation energy for a reaction.

Part 1 b) gives you the opportunity to apply your understanding of enzyme structure and function, and enzyme specificity. You are asked to explain the induced fit model of enzyme catalysis with a focus on the catalytic action of maltase. This description should include an account of why maltase

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is only able to catalyse the breakdown of maltose and not sucrose. This concept could be illustrated but including a diagram is optional.

For **part 2:** you need to discuss the effect that **both** competitive and non-competitive inhibitors have on the ability of enzymes to catalyse a reaction. You are presented with two diagrams (one which illustrates competitive inhibition and the other, non-competitive inhibition). In **i)** you are just asked to identify which diagram (inhibition Type 1 or inhibition Type 2) represents competitive inhibition, and which represents non-competitive inhibition. You will notice that in each diagram the enzyme is labelled but all other components are assigned a letter (from **A** to **F**). In **ii)** you are asked to identify what each letter represents, and any like components will only require one label. Therefore, although there are 6 letters, you will only state the name of four components. In **iii)** you will need to discuss the effect of inhibition Type 1 on the ability of an enzyme to catalyse a reaction. Here you can use the illustration to your advantage because describing it will help you to get the key points into the discussion. In **iv)** you will follow the same approach, but for inhibition Type 2. Finally, in **v)** you are expected to apply your understanding of the principles of enzyme inhibition to identify which type of inhibition the statement relates to. This question also requires an explanation and so as well as explaining why the identified type of inhibition is influenced by a change in substrate concentration, you also need to explain why the other is not.

TAQ.3

Part 1 a)- In this first part of TAQ.3 you are presented with a brief scenario and an accompanying data Table and plotted line graph. The data values recorded in **Table 4** are based on the results of an experiment where a student investigated the effects of temperature on the rate of an enzyme-catalysed reaction (with reaction rate displayed as 1/Time and the values set to the same standard form (e.g., 8×10^{-4},17×10^{-4}). **Graph 1** has been plotted from this data and it is included to allow you to observe the main trends.

In **part 1 a)** you need to explain (using the tabulated data values and line graph trend) the effect that different temperatures have had on the rate at which an enzyme can catalyse a chemical reaction. To provide an **effective discussion**, the data values documented in **Table 4**, should be referred to directly (covering rate of reaction at low, optimal, and high temperatures as a minimum). You need to explain the rate of reaction values stipulated, using level 3 Scientific theory on the effects that temperature has on enzyme activity. Consideration should be given to; kinetic energy, collision theory, enzyme-substrate complex formation, and enzyme denaturation. In addition, you should refer to the trend evident in the plotted graph. What does the direction and gradient of the line indicate has happened as temperature is increased at 10°C intervals?

For **part 1b)** you need to make use of the Q_{10} equation in the course materials when calculating Q_{10} at the three stipulated temperatures (T°C). You must show the method by which you arrived at each Q_{10} value. Refer to pages **31** and **32** of the reading materials to review how to carry out this calculation.

For **part 1c)** you need to explain what two of the Q_{10} values calculated (**ii** and **iii** specifically) allow you to conclude about the effect that a 10°C rise in temperature has on the rate of an enzyme-catalysed reaction. You will therefore need to read up on the principles of Q_{10} and again, the learning materials are a great place to start.

Part 2 of TAQ.3 has a similar feel to what you are being assessed on in Parts 1. Again, you are presented with a brief scenario and an accompanying data Table and plotted line graphs. The data values recorded in **Table 5** are based on the results of an experiment where a student investigated the effects of **pH** on the rate of two enzyme-catalysed reaction (with reaction rate displayed as 1/Time and the values set to the same standard form (e.g., 30×10^{-4},61×10^{-4}). The enzymes that have been investigated are both protease enzymes that are involved in chemical digestion (pepsin and trypsin). **Graph 2** has been plotted from this data and it is included to allow you to observe the main trends.

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In **part 2 a)** you need to explain (using the tabulated data values and line graph trends) the effect that differences in pH have had on the rate at which both pepsin and trypsin can catalyse a chemical reaction. To provide an **effective discussion**, the data values documented in **Table 5**, should be referred to directly in your account, taking into consideration the optimum pH and the pH either side of the optimum. You need to explain the rate of reaction values stipulated, using level 3 Scientific theory on the effects that pH has on the structure of an enzyme (with a focus on how bonding is affected).

In addition, you should refer to the trend evident in the plotted graph. What does the direction and gradient of the line for pepsin and trypsin indicate has happened either side of each enzyme's optimum? You might also want to state the pH range either side of the optimum that indicated enzyme denaturation.

In **Part 2 b** you are being assessed on your application of knowledge. Here you need to consider the pH either side of the optimum for pepsin that indicate total denaturation, and you also need to research the pH conditions of the duodenum. Eqipped with this information, you will be able to explain why pepsin would not have the ability to catalyse the hydrolysis of proteins when it reaches the duodenum.

TAQ.4

Part 1 a)- Due to the constraints of the word limit for this section of **TAQ.4**, you are only required to describe the specific function of the tabulated enzymes which are involved in the production of synthetic insulin rather than describing the process of recombinant DNA technology as a whole. You need to remember that one of the listed enzymes is used in isolating the required gene (from DNA in a human cell) and in preparing a plasmid to create recombinant DNA. Therefore, reference to the role of this enzyme in both processes is necessary. One of the enzymes in the Table is not covered in the learning materials so to summarise the function of this enzyme, you will need to do some wider reading.

In **part 1 b)** you are expected to explain the process of replica plating using the plasmid pBR322 specifically. This plasmid is commonly utilised in recombinant DNA technology because of its structural features. You will need to refer to these features in your account and explain how they are manipulated to ensure that transformed bacteria that possess recombinant plasmids (those that hold the insulin gene) can be isolated from either transformed bacteria that have taken up non-recombinant plasmids or non-transformed bacteria (that have not taken up the plasmid at all). You might want to include a supporting labelled diagram as part of your response, and you could add annotation to the diagram to reduce the word count.

In **part 1 c)** you need to outline the final stage in the process of creating synthetic insulin. This will require you to demonstrate an understanding of why a commercial scale fermenter is used.

Part 2 a)- You are expected to describe how the process of PCR allows amplification of a minute sample of DNA recovered from a crime scene so that the DNA can then be used in DNA profiling using gel electrophoresis. In this account you are expected to refer to the ingredients that are added to the machine, temperature changes, strand separation, the role of primers, DNA synthesis and repeat cycling. You are encouraged to support this account with inclusion of a labelled diagram.

Part 2 b)- You need to describe (in overview), how gel electrophoresis can be used to visualise amplified DNA to allow DNA profiling. Reference should be given to the preparation stage, running the gel (by applying an electrical current) and Southern Blotting**.**

Part 2 c)- With this question the aim is for you to use the evidence in the Sothern blot (**Figure.1**) to identify the guilty suspect (based on the pattern of DNA banding. It is not enough to just state which suspect from the three committed the crime, you also need to explain you conclusion with reference to banding patterns.

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Before submitting your assessment, make sure that you proofread your answers carefully to check communication, spelling, and grammar. Include all your word counts where indicated on the student answer sheet and add these up. If you have gone over this, you will need to condense some of your answers.

Also make sure you have included a bibliography after each TAQ. You should be using appropriate resources aimed at level 3 to build on the information provided in the materials to access the higher grades. Remember as this is a science unit, there is no need for in-text referencing.

You will have included a number of hand-drawn diagrams in some of your answers. If you find that the file size is large, you may need to condense this. There is some advice on how to do this in the How to Guide on IT found in the materials section of the website under the Developmental section. If your assessment doesn't upload to the website this could be the issue here. If you still have problems with this, please contact technical support.

Finally, put your assessment through Turnitin and check the originality report. Are there any areas where it looks as though you have relied too heavily on the source material – are some full sentences or paragraphs highlighted, are there any sections highlighted where only the odd word here and there is your own. If so, go back to these parts and edit them. You can put your new work through Turnitin again to check you have made the correct changes.
Once you are happy with your work, upload your Student Answer Sheet and your Turnitin originality report to the 'my assessments' areas of your account and make a start on the next learning materials as stated in your Individual Learning Plan.

I hope you enjoyed this interesting area of Biochemistry.