Stage 2 Chemistry

Assessment type and task are clearly identified.

Assessment Type 1: Investigations Folio

Practical (Design): Rate of Reaction

Purpose

This assessment provides you with the opportunity to investigate concepts relating to the rate of an enzyme-controlled reaction, and to demonstrate your ability to:

* formulate hypotheses

The purpose of the task links it to the Learning Requirements and the Assessment Design Criteria being assessed.

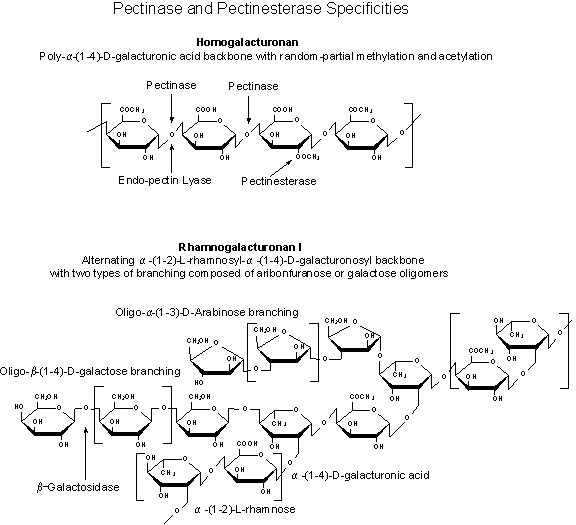
* design and conduct an investigation
* identify variables and collect, analyse, and interpret data
* evaluate results, form conclusions, and communicate your understanding of concepts.

Description of assessment

Introduction

Pectinase is a general term for [enzymes](http://en.wikipedia.org/wiki/Enzymes), such as polygalacturonase, which break down [pectin](http://en.wikipedia.org/wiki/Pectin), a polysaccharide substrate that is found in the cell walls of [plants](http://en.wikipedia.org/wiki/Plants). Pectinase is used commercially to aid in extracting juice from fruit. By enzymatically breaking down the cell wall, pectinase releases the juice from within the cells.

Pectinis a molecule similar to starch except that the repeating unit of pectin is galacturonic acid instead of glucose, as in starch. Galacturonic acid is similar to glucose, except one of the C atoms has a –COOH group attached instead of a –CH2‑OH.



In this investigation, you can apply pectinase to fruit under controlled experimental conditions in order to investigate the enzyme activity of pectinase. You can monitor the enzyme activity by measuring how much juice is produced under the various experimental conditions. Some possible conditions to investigate are duration of enzyme treatment, enzyme concentration, and temperature.

A procedure for the extraction of juice from apricots is outlined below.

1. Use a balance to weigh some chopped apricot into a beaker.
2. Prepare a pectinase solution according to the manufacturer's instructions.
3. Add some diluted enzyme to the beaker.
4. Put the beaker into a water bath for a certain time period. Remove the beaker from water bath and use a wooden spoon to gently stir/squeeze the apricot pieces in each.
5. Use a paper coffee filter in a funnel to filter the juice from the fruit into graduated cylinder.

Task

Preliminary Investigation

Carry out some preliminary work in the laboratory to test the procedure for extracting juice from fruit. Work with your partner to test a variable of your choice and to determine suitable amounts of fruit and enzyme solution to produce results that are measurable and reasonable. Document your procedure and results. Evaluate your procedure and results to help develop your hypothesis and procedure for your final investigation.

Proposal

Hand up your proposal, with your notes from the preliminary investigation attached, to be assessed before you carry out your investigation.

Include

* the purpose of your investigation

The Preliminary Investigation and Proposal provide evidence of design skills.

* the hypothesis
* the independent variable
* the dependent variable
* a detailed list of materials required for your investigation
* your procedure
* a safety audit that recognises potential hazards and identifies procedures used to minimise hazards.

Experimental Investigation

Conduct an investigation to test the hypothesis.

Report

Produce a scientific report for the investigation.

Include the following:

* the hypothesis
* the independent and dependent variables
* a clear and detailed procedure
* results presented in appropriate formats
* analysis of the data with reference to the trends evident and formulate a conclusion
* evaluation of your procedure including a discussion of the factors kept constant, the accuracy and precision of the measurements, sources of systematic and random errors and the reliability of the conclusion

Assessment Conditions

The preliminary experiments are conducted over one week. The investigation proposal is submitted and feedback provided. One double lesson is allocated for the practical investigation and one further week of the students’ own time is allowed for the report to be written. The original proposal is also submitted with the report.

Students work collaboratively on the preliminary investigation, the proposal and the final investigation but individually on the report.

The checklist provides evidence of work skills.

Teacher Checklist for A3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skill** | **very good** | **good** | **satisfactory** | **poor** | **limited** |
| Collaboration in discussion/development of plan |  |  |  |  |  |
| Collaboration in preliminary laboratory work |  |  |  |  |  |
| Collaboration in final investigation |  |  |  |  |  |
| Individual initiative and focus during investigation |  |  |  |  |  |

**Performance Standards for Stage 2 Chemistry**

|  | Investigation | Analysis and Evaluation | | | Application | Knowledge and Understanding | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A | Designs **logical, coherent,** and **detailed** chemistry investigations.  **Critically** and **logically** selects and **consistently** and **appropriately** acknowledges information about chemistry and issues in chemistry from a **range** of sources.  Manipulates apparatus and technological tools **carefully** and **highly effectively** to implement **well-organised** safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using **appropriate** conventions and formats accurately and **highly** effectively. | | **Critically** and **systematically** **analyses** data and their connections with concepts, to formulate **logical** and **perceptive** conclusions and make **relevant** predictions.  **Critically** and **logically** **evaluates** procedures and suggests a **range** of **appropriate** improvements.  . | Applies chemistry **concepts** and evidence from investigations to suggest solutions to **complex** problems in **new and** familiar contexts.  Uses **appropriate** chemical terms, conventions, formulae, and equations **highly effectively**.  Demonstrates **initiative** in applying **constructive** and **focused** individual and collaborative work skills. | | | **Consistently** demonstrates a **deep** and **broad** knowledge and understanding of a **range** of chemistry concepts.  Uses knowledge of chemistry **perceptively** and **logically** to understand and explain social or environmental issues.  Uses a **variety** of formats to communicate knowledge and understanding of chemistry **coherently** and **highly effectively**. |
| B | Designs **well-considered** and **clear** chemistry investigations.  **Logically** selects and **appropriately** acknowledges information about chemistry and issues in chemistry from **different** sources.  Manipulates apparatus and technological tools **carefully** and **mostly effectively** to implement **organised** safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using **appropriate** conventions and formats **mostly** accurately and effectively. | | **Clearly** and **logically** **analyses** data and their connections with concepts, to formulate **consistent** conclusions and make **mostly** **relevant** predictions.  **Logically** **evaluates** procedures and suggests **some appropriate** improvements. | Applies chemistry **concepts** and evidence from investigations to suggest solutions to problems in **new and** familiar contexts.  Uses **appropriate** chemical terms, conventions, formulae, and equations **effectively**.  Applies **mostly constructive** and **focused** individual and collaborative work skills. | | | Demonstrates **some depth** and **breadth** of knowledge and understanding of a **range** of chemistry concepts.  Uses knowledge of chemistry **logically** to understand and explain social or environmental issues.  Uses a **variety** of formats to communicate knowledge and understanding of chemistry **coherently** and **effectively**. |
| C | Designs **considered** and **generally clear** chemistry investigations.  Selects with **some focus**, and **mostly appropriately** acknowledges, information about chemistry and issues in chemistry from **different** sources.  Manipulates apparatus and technological tools **generally carefully** and **effectively** to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using **generally** **appropriate** conventions and formats with some errors but **generally** accurately and effectively. | | **Analyses** data and their connections with concepts, to formulate **generally appropriate** conclusions and make **simple** predictions, with **some** **relevance**.  **Evaluates** **some** procedures in chemistry and suggests **some** improvements that are **generally appropriate**. | Applies chemistry **concepts** and evidence from investigations to suggest **some** solutions to **basic** problems in **new or** familiar contexts.  Uses **generally appropriate** chemical terms, conventions, formulae, and equations with **some general effectiveness**.  Applies **generally constructive** individual and collaborative work skills. | | | Demonstrates knowledge and understanding of a **general range** of chemistry concepts.  Uses knowledge of chemistry with **some logic** to understand and explain **one or more** social or environmental issues.  Uses **different** formats to communicate knowledge and understanding of chemistry with **some general effectiveness**. |
| D | Prepares the **outline** of **one or more** chemistry investigations.  Selects and **may** **partly** acknowledge **one or more** sources of information about chemistry **or an** issue in chemistry.  Uses apparatus and technological tools with **inconsistent care** and **effectiveness** and **attempts** to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using conventions and formats **inconsistently,** with **occasional** accuracy and effectiveness. | | **Describes basic** connections between **some** data and concepts, and **attempts** to formulate **a** conclusion and make **a** **simple** prediction that **may be relevant**.  For **some** procedures, **identifies** improvements that may be made. | Applies **some** evidence to describe **some** **basic** problems and identify **one or more** **simple** solutions, in familiar contexts.  Attempts to use **some** chemical terms, conventions, formulae, and equations that **may be appropriate**.  Attempts individual work **inconsistently**, and contributes **superficially** to aspects of collaborative work. | | | Demonstrates **some basic** knowledge and **partial** understanding of chemistry concepts.  Identifies and explains **some** chemistry information that is relevant to **one or more** social or environmental issues.  Communicates **basic** information to others using **one or more** formats. |
| E | Identifies a **simple** procedure for **a** chemistry investigation.  **Identifies a** source of information about chemistry **or an** issue in chemistry.  **Attempts** to use apparatus and technological tools with **limited** **effectiveness or attention** to safe or ethical investigation procedures.  **Attempts** to record and display **some** descriptive information about **an** investigation, with **limited** accuracy or effectiveness. | | **Attempts** to connect data with concepts, formulate **a** conclusion, and make **a** prediction.  **Acknowledges** the need for improvements in **one or more** procedures. | Identifies **a** **basic** problem and **attempts** to identify **a** solution in a familiar context.  Identifies **some** chemical terms or formulae.  Shows **emerging** skills in individual and collaborative work. | | | Demonstrates **some** **limited** recognition and awareness of chemistry concepts.  Shows an **emerging** understanding that **some** chemistry information is relevant to social or environmental issues.  **Attempts** to communicate information about chemistry. |

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| --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C**  Some teachers have found this format of the Performance Standards useful in recording student achievement in the relevant specific features. | **D** | **E** |
| **Investigation** | Designs **logical, coherent,** and **detailed** chemistry investigations.  **Critically** and **logically** selects and **consistently** and **appropriately** acknowledges information about chemistry and issues in chemistry from a **range** of sources.  Manipulates apparatus and technological tools **carefully** and **highly effectively** to implement **well-organised** safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using **appropriate** conventions and formatsaccurately and **highly** effectively. | Designs **well-considered** and **clear** chemistry investigations.  **Logically** selects and **appropriately** acknowledges information about chemistry and issues in chemistry from **different** sources.  Manipulates apparatus and technological tools **carefully** and **mostly effectively** to implement **organised** safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using **appropriate** conventions and formats **mostly** accurately and effectively. | Designs **considered** and **generally clear** chemistry investigations.  Selects with **some focus,** and **mostly appropriately** acknowledges, information about chemistry and issues in chemistry from **different** sources.  Manipulates apparatus and technological tools **generally carefully** and **effectively** to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using **generally appropriate** conventions and formatswith some errors but **generally** accurately and effectively. | Prepares the **outline** of **one or more** chemistry investigations.  Selects and **may partly** acknowledge **one or more** sources of information about chemistry **or** **an** issue in chemistry.  Uses apparatus and technological tools with **inconsistent care** and **effectiveness** and **attempts** to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using conventions and formats **inconsistently,** with **occasional** accuracy and effectiveness. | Identifies a **simple** procedure for **an** chemistry investigation.  **Identifies a** source of information about chemistry **or an** issue in chemistry.  **Attempts** to use apparatus and technological tools with **limited** **effectiveness or attention** to safe or ethical investigation procedures.  **Attempts** to record and display **some** descriptive information about **an** investigation, with **limited** accuracy or effectiveness. |
| **Analysis and Evaluation** | **Critically** and **systematically analyses** data and their connections with concepts to formulate **logical** and **perceptive** conclusions and make **relevant** predictions.  **Critically** and **logically evaluates** procedures and suggests a **range** of **appropriate** improvements. | **Clearly** and **logically analyses** data and their connections with concepts to formulate **consistent** conclusions and make **mostly relevant** predictions.  **Logically evaluates** procedures and suggests **some appropriate** improvements. | **Analyses** data and their connections with concepts to formulate **generally appropriate** conclusions and make **simple** predictions with **some relevance.**  **Evaluates some** procedures in chemistry and suggests **some** improvements that are **generally appropriate**. | **Describes basic** connections between **some** data and concepts and **attempts** to formulate **a** conclusion and make **a simple** prediction that **may be relevant.**  For **some** procedures, **identifies** improvements that may be made. | **Attempts** to connect data with concepts, formulate **a** conclusion and make **a** prediction.  **Acknowledges** the need for improvements in **one or more** procedures. |
| **Application** | Applies chemistry **concepts** and evidence from investigations to suggest solutions to **complex** problems in **new and** familiar contexts.  Uses **appropriate** chemistry terms, conventions, formulae, and equations **highly effectively**.  Demonstrates **initiative** in applying **constructive** and **focused** individual and collaborative work skills. | Applies chemistry **concepts** and evidence from investigations to suggest solutions to problems in **new and** familiar contexts.  Uses **appropriate** chemistry terms, conventions, formulae, and equations **effectively**.  Applies **mostly constructive** and **focused** individual and collaborative work skills. | Applies chemistry **concepts** and evidence from investigations to suggest **some** solutions to **basic** problems in **new or** familiar contexts.  Uses **generally appropriate** chemistry terms, conventions, formulae, and equations with **some general effectiveness**.  Applies **generally constructive** individual and collaborative work skills. | Applies **some** evidence to describe **some** **basic** problems and identify **one or more** **simple** solutions, in familiar contexts.  Attempts to use **some** chemistry terms, conventions, formulae, and equations that **may be appropriate**.  Attempts individual work **inconsistently**, and contributes **superficially** to aspects of collaborative work. | Identifies **a** **basic** problem and **attempts** to identify **a** solution in a familiar context.  Uses **some** chemistry terms **or** formulae.  Shows **emerging** skills in individual and collaborative work. |
| **Knowledge and Understanding** | **Consistently** demonstrates a **deep** and **broad** knowledge and understanding of a **range** of chemistry concepts and practices.  Uses knowledge of chemistry **perceptively** and **logically** to understand and explain social, economic, or environmental issues.  Uses a **variety** of formats to communicate knowledge and understanding of chemistry **coherently** and **highly effectively**. | Demonstrates **some** **depth** and **breadth** of knowledge and understanding of a **range** of chemistry concepts and practices.  Uses knowledge of chemistry **logically** to understand and explain social, economic, or environmental issues.  Uses a **variety** of formats to communicate knowledge and understanding of chemistry **coherently** and **effectively**. | Demonstrates knowledge and understanding of a **general range** of chemistry concepts and practices.  Uses knowledge of chemistry with **some logic** to understand and explain **one or more** social, economic, or environmental issues.  Uses **different** formats to communicate knowledge and understanding of chemistry with **some general effectiveness**. | Demonstrates **some basic** knowledge and **partial** understanding of chemistry concepts **and/or** practices.  Identifies and explains **some** chemistry information that is relevant to **one or more** social, economic, or environmental issues.  Communicates **basic** information to others using **one or more** formats. | Demonstrates **some limited** recognition and awareness of chemistry concepts **or** practices.  Shows an **emerging** understanding that **some** chemistry information is relevant to social, economic, or environmental issues.  **Attempts** to communicate information about chemistry. |