



Maroochydore State High School

Chemistry

IA3

Student name

Student number

Teacher

Issued

18/05/2020

Due date

07/08/2020

Marking summary

Criterion	Marks allocated	Provisional marks
Research and planning	6	
Analysis and interpretation	6	
Conclusion and evaluation	6	
Communication	2	
Overall	20	

Conditions

Technique	Research investigation
Unit	Unit 4: Structure, synthesis and design
Topic/s	Topic 1: Properties and structure of organic materials Topic 2: Chemical synthesis and design
Duration	10 hours of class time
Mode / length	Written (e.g. scientific essay): 1500–2000 words
Individual / group	Individual
Resources	School library (online: internet and school intranet, databases, journals)

Context

Investigate one of the following claims:

- Organochlorine compounds are more effective insecticides.
- The chemical properties of plastics make them biodegradable.
- The chemical properties of unsaturated fats make them better than saturated fats.
- The effectiveness of a sugar depends on its monomer.
- The structure of a polymer determines its usefulness.

Task

To complete this task, you must

- select a claim to be evaluated
- identify the relevant scientific concepts associated with the claim
- pose a research question addressing an aspect of the claim
- conduct research to gather scientific evidence that may be used to address the research question and subsequently evaluate the claim
- analyse the data to identify sufficient and relevant evidence
- identify the trends, patterns or relationships in the evidence
- analyse the evidence to identify limitations
- interpret the evidence to construct justified scientific arguments
- interpret the evidence to form a justified conclusion to the research questions
- discuss the quality of the evidence
- evaluate the claim by extrapolating the findings of the research question to the claim
- suggest improvements and extension to the investigation
- communicate findings in an appropriate scientific genre, i.e. scientific essay.

Checkpoints

- Term 2 Week 5 Lesson 1 Hand out Research Investigation
- Term 2 Week 7 Lesson 1 Research Question approved
- Term 2 Week 9 Lesson 1 Data progress check
- Term 2 Week 10 Lesson 1 Analyse and evaluation of evidence progress check
- Term 3 Week 1 Lesson 3 Draft due via TurnItIn
- Term 3 Week 4 Lesson 3 Submit final via TurnItIn

Authentication strategies

- You will be provided class time for task completion.
- Your teacher will observe you completing work in class.
- Your teacher will collect and annotate a draft.
- You must acknowledge all sources.
- Your teacher will ensure class cross-marking occurs.
- You will use TurnItIn to submit your response.

Scaffolding

The response must be presented using an appropriate scientific genre (I.e. empirical essay) and contain:

- a claim
- a research question
- a rationale for the investigation
- justified scientific arguments using evidence
- a conclusion to the research question based on the interpretation of the evidence
- evaluation of the claim and suggestions of improvements and extension to the investigation
- a reference list

An example of how one of the claims could be developed into a research question

Claim: Plastics are bad for the environment.

Research question: What effect do catalysts have on the chemical recycling of polyethylene terephthalate (PET) by glycolysis?

Developing the research question:

1. Identify the key (important) terms in the claim.

a. 'plastics', 'bad', 'environment'

2. Propose refining questions that need to be addressed to refine key terms and narrow the focus of the claim.

a. Which plastic will I investigate?

b. Why did I choose this plastic?

c. What do I mean by 'bad' for the environment in chemical terms?

3. Provide an example of how one of the claims could be developed into a research question. Conduct research to gather information to address the refining questions.

a. The plastic that will be investigated is PET.

b. PET's structural and chemical properties make it a high-demand plastic that is not biodegradable. Therefore, it is an environment problem if not recycled.

c. PET can be recycled by a chemical process called glycolysis, which requires a catalyst.

d. Products from chemically recycling PET can be used as feedstock (raw materials) for other products.

4. Draft the research question to address the claim.

a. How does chemically recycling PET help the environment?

5. Refine and focus the research question.

a. How does chemically recycling PET by glycolysis help the environment?

b. What factors affect the chemical recycling of PET by glycolysis?

6. Present the research question to the teacher for approval.

a. What effect do catalysts have on the chemical recycling of polyethylene terephthalate (PET) by glycolysis?

*Note: You cannot use this sample research question for your investigation.

Instrument-specific marking guide (IA3): Research investigation (20%)

Criterion: Research and planning

Assessment objectives

2. apply understanding of the properties and structure of organic materials or chemical synthesis and design to develop research questions
5. investigate phenomena associated with the properties and structure of organic materials or chemical synthesis and design through research

The student work has the following characteristics:	Marks
<ul style="list-style-type: none">• <u>informed application</u> of understanding of the properties and structure of organic materials or chemical synthesis and design demonstrated by a <u>considered rationale</u> identifying <u>clear</u> development of the <u>research question</u> from the <u>claim</u>• <u>effective and efficient investigation</u> of <u>phenomena</u> associated with the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– a <u>specific</u> and <u>relevant</u> research question– <u>selection</u> of <u>sufficient</u> and <u>relevant</u> sources.	5–6
<ul style="list-style-type: none">• <u>adequate application</u> of understanding of the properties and structure of organic materials or chemical synthesis and design demonstrated by a <u>reasonable rationale</u> that links the <u>research question</u> and the <u>claim</u>• <u>effective investigation</u> of <u>phenomena</u> associated with the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– a <u>relevant</u> research question– <u>selection</u> of relevant sources.	3–4
<ul style="list-style-type: none">• <u>rudimentary application</u> of understanding of the properties and structure of organic materials or chemical synthesis and design demonstrated by a <u>vague</u> or <u>irrelevant rationale</u> for the <u>investigation</u>• <u>ineffective investigation</u> of <u>phenomena</u> associated with the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– an <u>inappropriate</u> <u>research question</u>– <u>selection</u> of <u>insufficient</u> and <u>irrelevant</u> sources.	1–2
<ul style="list-style-type: none">• does not satisfy any of the descriptors above.	0

Criterion: Analysis and interpretation

Assessment objectives

3. analyse research evidence about the properties and structure of organic materials or chemical synthesis and design
4. interpret research evidence about the properties and structure of organic materials or chemical synthesis and design

The student work has the following characteristics:	Marks
<ul style="list-style-type: none">• <u>systematic and effective analysis</u> of qualitative data and/or quantitative <u>data</u> within the sources about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– the <u>identification</u> of <u>sufficient</u> and <u>relevant</u> <u>evidence</u>– <u>thorough</u> identification of <u>relevant</u> <u>trends</u>, <u>patterns</u> or <u>relationships</u>– thorough and <u>appropriate</u> identification of <u>limitations</u> of <u>evidence</u>• <u>insightful interpretation</u> of research evidence about the properties and structure of organic materials or chemical synthesis and design demonstrated by <u>justified</u> scientific <u>argument</u> /s.	5–6
<ul style="list-style-type: none">• <u>effective analysis</u> of qualitative data and/or quantitative <u>data</u> within the sources about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– the <u>identification</u> of <u>relevant</u> <u>evidence</u>– identification of <u>obvious</u> <u>trends</u>, <u>patterns</u> or <u>relationships</u>– <u>basic</u> identification of <u>limitations</u> of <u>evidence</u>• <u>adequate interpretation</u> of research <u>evidence</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by <u>reasonable</u> scientific <u>argument</u> /s.	3–4
<ul style="list-style-type: none">• <u>rudimentary analysis</u> of qualitative data and/or quantitative <u>data</u> within the sources about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– the <u>identification</u> of <u>insufficient</u> and <u>irrelevant</u> <u>evidence</u>– identification of <u>incorrect</u> or irrelevant <u>trends</u>, <u>patterns</u> or <u>relationships</u>– incorrect or insufficient identification of <u>limitations</u> of <u>evidence</u>• <u>invalid interpretation</u> of research <u>evidence</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by <u>inappropriate</u> or irrelevant <u>argument</u> /s.	1–2
<ul style="list-style-type: none">• does not satisfy any of the descriptors above.	0

Criterion: Conclusion and evaluation

Assessment objectives

4. interpret research evidence about the properties and structure of organic materials or chemical synthesis and design
6. evaluate research processes, claims and conclusions about the properties and structure of organic materials or chemical synthesis and design

The student work has the following characteristics:	Marks
<ul style="list-style-type: none">• <u>insightful interpretation</u> of research <u>evidence</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by <u>justified conclusion</u> /s linked to the <u>research question</u>• <u>critical evaluation</u> of the research <u>processes</u>, <u>claims</u> and <u>conclusions</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– <u>insightful discussion</u> of the <u>quality of evidence</u>– <u>extrapolation</u> of <u>credible findings</u> of the research to the claim– <u>suggested improvements</u> and <u>extensions</u> to the <u>investigation</u> that are <u>considered</u> and <u>relevant</u> to the claim.	5–6
<ul style="list-style-type: none">• <u>adequate interpretation</u> of research <u>evidence</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by <u>reasonable conclusion</u> /s <u>relevant</u> to the <u>research question</u>• <u>basic evaluation</u> of the research <u>processes</u>, <u>claims</u> and <u>conclusions</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– <u>reasonable description</u> of the <u>quality of evidence</u>– <u>application</u> of relevant <u>findings</u> of the research to the claim– <u>suggested improvements</u> and <u>extensions</u> to the <u>investigation</u> that are relevant to the claim.	3–4
<ul style="list-style-type: none">• <u>invalid interpretation</u> of research <u>evidence</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by <u>inappropriate</u> or <u>irrelevant conclusion</u> /s• <u>superficial evaluation</u> of the research <u>processes</u>, <u>claims</u> and <u>conclusions</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– <u>cursory</u> or <u>simplistic</u> statements about the <u>quality of evidence</u>– <u>application</u> of <u>insufficient</u> or <u>inappropriate findings</u> of the research to the claim– <u>ineffective</u> or irrelevant suggestions.	1–2
<ul style="list-style-type: none">• does not satisfy any of the descriptors above.	0

Criterion: Communication

Assessment objectives

7. communicate understandings and research findings, arguments and conclusions about the properties and structure of organic materials or chemical synthesis and design.

The student work has the following characteristics:	Marks
<ul style="list-style-type: none">• <u>effective communication</u> of <u>understandings</u> and research <u>findings</u>, <u>arguments</u> and <u>conclusions</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– <u>fluent and concise use of scientific language</u> and <u>representations</u>– <u>appropriate use of genre conventions</u>– <u>acknowledgment</u> of sources of information through <u>appropriate use of referencing conventions</u>.	2
<ul style="list-style-type: none">• <u>adequate communication</u> of <u>understandings</u> and research <u>findings</u>, <u>arguments</u> and <u>conclusions</u> about the properties and structure of organic materials or chemical synthesis and design demonstrated by<ul style="list-style-type: none">– <u>competent use of scientific language</u> and <u>representations</u>– <u>use of basic genre conventions</u>– <u>use of basic referencing conventions</u>.	1
<ul style="list-style-type: none">• does not satisfy any of the descriptors above.	0