General Instructions

Reading time – 3 minutes Working time – 45 minutes

Write your answers using a pen in the spaces provided. If you need additional space to answer a question, use the blank space at the end of the same page OR at the end of the paper and clearly indicate that this has been done.

This task is out of 30 marks.

Task Weighting: 12.5% of your school-based chemistry assessment.

Question 1. (H12) (2 marks)

Identify a practising Australian chemist and outline the area in which this chemist is currently working.

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Question 2. (H4) (3 marks)

Assess the impact of the application of CFCs on society.

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Question 3. (H9) (2 marks)

A halogenated hydrocarbon, $C_4H_5F_2Cl$, has $CH_2CHCHClCHF_2$ as its condensed structural formula.

(a) Identify its systematic IUPAC name. (1 mark)

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(b) Draw the full structural formula for an isomer of $C_4H_5F_2Cl$. (1 mark)

Question 4. (H9, H10, H13) (6 marks)

Freon-13 has the formula CF_3Cl.

It is a CFC that was used, prior to 1996, as a working fluid in refrigeration and air conditioning.

(a) Outline how Freon-13 is able to destroy the ozone layer, using relevant equations. (2 marks)

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(b) An aged refrigerator is slowly leaking Freon-13 at a rate of 1 kg per annum.

(i) Calculate the number of chlorine atoms (free radicals) that will be released into the atmosphere over a 12 month period. Show full and appropriate working.(2 marks)

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(ii) Calculate the mass of ozone that will be degraded, assuming that each molecule of CFC is able to 'attack' or destroy one thousand (1000) ozone molecules in a chain reaction before the chain reaction is broken. Show full and appropriate working. (2 marks)

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Question 5. (H1) (3 marks)

Identify a major advance in the scientific understanding of the chemistry of the ozone layer and outline how the advance changed the nature of scientific thinking.

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Question 6. (H4, H5) (4 marks)

(a) Describe, using examples, the environmental impacts of the use of soaps and synthetic detergents. (3 marks)

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(b) Propose a possible future direction of chemical research to reduce the impact of soaps and synthetic detergents on the environment. (1 mark)

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Question 7. (H2) (4 marks)

Sodium palmitate, ($NaCH_3(CH_2)_{14}CO_2$), is the name of the soap produced by the saponification of palm oil.
The Law of conservation of charge states that "charge cannot be created or destroyed".

(a) Draw a model to appropriately represent a molecule of sodium palmitate dissolving in water. The model should reflect the properties of the products of this process that make sodium palmitate an emulsifier. (3 marks)

(b) How is the model above consistent with the Law of conservation of charge? (1 mark)

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Question 8. (H3, H4) (6 marks)

Soaps were the first cleaning agents. Advances in chemistry led to improved cleaning technology.

(a) Compare the composition of two types of synthetic detergent AND relate their composition to one use of each in the home or in industry. (4 marks)

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(b) Assess the importance of understanding chemical composition in developing improved cleaning technology. (2 marks)

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Chemistry Research/Practical processes Assessment task

Part A – Practical investigations

You will be required to carry out two separate practical investigations at home, write them up as separate formal scientific reports and submit the two reports for marking. More information regarding the nature of the reports that you should prepare for marking will be supplied at a later date.

The syllabus dot-points that will be the basis of the two practical investigations are:

Perform a first-hand investigation to gather information and describe the properties of a named emulsion and relate these properties to its use.

Perform a first-hand investigation to demonstrate the effect of soap as an emulsifier

Part B –– Research Task Requirements:

You are to research the following three syllabus content areas and on the due date, you will be required to sit for a test of 45 minutes duration based on your research. You may bring **only** your completed research assignment into the test. Your assignment must be handed in at the conclusion of the test, along with the test.

The research answers that you submit must be your own work. Serious penalties apply for plagiarism and cheating (zero marks may be awarded for the entire task). Direct quotes from your sources must be presented and acknowledged using footnotes and references. Each of the sections must be submitted stapled individually using only a staple in the top left hand corner. Do not submit work in a plastic sleeve or any type of folder. Place your name and your teacher's name on the front page of each section with each section beginning on a new page. Each of the three sections must have a bibliography (including web references with the full URL where used), which must be able to be substantiated if required. It is expected that more than two references be used in establishing facts used in your answers. The submitted work must be set out in an appropriate manner in accordance with the outcomes set out in **H13**

Refer to the ***glossary of key words***, as this will provide important information about the depth and nature of the answers required.

You are to research the following HSC Chemistry syllabus areas in preparation for the formal part of assessment task in class.

Section 1: Address the following from 9.4.1

* use the internet to research the following and clearly state a web address where the details of your practising scientists can be verified.

  -identify a practising male and female Australian chemist
  -name the industry or organisation in which they work
  -identify the branch of Chemistry undertaken and explain a chemical principle that each of the chemist uses
* *identify the need for collaboration between chemists as they collect and analyse data*

Some possible scientists that you could consider are – Gemma Thompson, Jenny Smith, Vanessa Ralph, Robert Evans, Gary Bowman, David Murray

Section 2: Address the following from 9.4.4

* *identify the origins of chlorofluorocarbons (CFCs) and halons in the atmosphere*
* *identify and name examples of isomers (excluding geometrical and optical) of haloalkanes up to eight carbon atoms*
* *discuss the problems associated with the use of CFCs and assess the effectiveness of steps taken to alleviate these problems*
* *analyse the information available that indicates changes in atmospheric ozone concentrations, describe the changes observed and explain how this information was obtained*
* *present information from secondary sources to write the equations to show the reactions involving CFCs and ozone to demonstrate the removal of ozone from the atmosphere*
* *present information from secondary sources to identify alternative chemicals used to replace CFCs and evaluate the effectiveness of their use as a replacement for CFCs*

Section 3: Address the following from 9.5.5

* *account for the cleaning action of soap by describing its structure*
* *explain that soap, water and oil together form an emulsion with the soap acting as an emulsifier*
* *distinguish between soaps and synthetic detergents in terms of:*
  - *the structure of the molecule*
  - *chemical composition*
  - *effect in hard water*
* *distinguish between anionic, cationic and non-ionic synthetic detergents in terms of:*
  - *chemical composition*
  - *uses*
* *solve problems and use available evidence to discuss, using examples, the environmental impacts of the use of soaps and detergents*

Part A – Guidelines for the Practical Reports

Submit the formal reports for these investigations as two separate practical reports.
As a guide, each report will likely be between 2 and 3 pages in length.
The following provides details of the requirements for the two reports.

Report 1. Making a useful consumer emulsion.

The first report relates to the syllabus dot-point –

- ***"perform a first-hand investigation to gather information and describe the properties of a named emulsion and relate these properties to its use".***

You could consider making one of the following emulsions for this first hand investigation – ice cream, butter, mayonnaise, vinaigrette, hand cream, cold cream.

Aim

A specific statement of what you intend to investigate.

Background Information

This section of your report includes relevant information that you have gathered from secondary sources that enable you to better understand and explain the results obtained. Answer the following questions to provide the appropriate background information.

1. *Describe what an emulsion is.*
2. *Outline the generalised structure of an emulsifying agent (emulsifier).*
   A labelled diagram should be used to clarify your answer.
3. *Explain the role of an emulsifying agent in the formation of an emulsion.*
4. *Identify the two types of emulsions and for each, present a simple, labelled diagram to show the arrangement of the various components of the emulsion.*

Method

Describe in simple past tense what was done in the investigation. You should describe the procedure used, the materials used and the quantities measured (including the units used). A labelled diagram could be useful to help clarify the description of the method.

Results

Describe all observations that were made.

Discussion

1. *Discuss the emulsion you made – identify the two types of liquids that are being emulsified; identify the emulsifying agent; identify the type of emulsion that has been made; identify its key characteristics; etc.*
2. *Outline the use(s) of the emulsion you have made.*
3. *Relate the properties of the emulsion you have made to its uses.*
4. *Recount any problems encountered and outline what was done to overcome them.*

Conclusion

This should be a short statement related to the aim of the investigation that summarises what was found out.

Report 2. Soap as an emulsifier.

The second report relates to the syllabus dot-point –

- *"perform a first-hand investigation to demonstrate the effect of soap as an emulsifier"*.

NOTE: Use either oil and water OR kerosene and water for this investigation.
Use soap (such as Lux™ flakes or a pure bathroom soap cake) rather than detergent.

Aim

To demonstrate that adding soap to an oil/water (or kerosene/water) mixture enables an emulsion to form.

Background Information

The usefulness of soap lies in its function as a surfactant and an emulsifier. Soap's emulsifying, cleaning action is directly related to its molecular structure.

1. *Outline what is meant by the term 'surfactant'.*
2. *Sodium stearate is a commonly used soap.*
   Show, by drawing its structural formula, the types and arrangement of atoms in sodium stearate.
3. *Show, by drawing its structural formula, the types and arrangement of atoms in another common soap molecule.*

Method

Part (i).

1. Transfer1 cup of water into a large glass jar (or other suitable container).
2. Add ¼ cup of oil (or kerosene).
3. Screw the lid onto the jar firmly and shake vigorously for a minute.
4. Record your immediate observations.
5. Allow the mixture to rest for 10 minutes.
6. Record your observations.

Part (ii)

7. Transfer 1 cup of soap solution to a large glass jar.
8. Repeat steps 2 to 6 from above.

Results

Describe all observations that were made.

Discussion

1. *Compare the results obtained in Part (i) and Part (ii), AND explain the observed differences.*
2. *Identify -*
   (a) the independent variable in this investigation.
   (b) the dependent variable in the investigation.
   (c) two variables that were controlled (kept constant).
3. *Identify the control and explain its purpose.*
4. *Assess the validity of the results obtained.*

Conclusion

This should be a short statement related to the aim of the investigation that summarises what was found out.