



SAMPLE ASSESSMENT TASKS

CHEMISTRY
GENERAL YEAR 11

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Sample assessment task

Chemistry – General Year 11

Task 1 – Unit 1

Assessment type: Investigation

Conditions

Period allowed for completion of the task: one week

An in-class practical investigation

Task weighting

8% of the school mark for this pair of units

Investigation to find out if seaweed contains chlorophyll

22 marks

In this task, you will carry out solvent extraction on dried seaweed and spinach. The extracts are then processed using paper chromatography.

The steps involved

Phase 1 – Planning (individual, followed by group refinement)

Phase 2 – Carrying out of experiment (group work)

Phase 3 – Data processing and analysis (individual, followed by group refinement)

Phase 4 – Evaluation (individual, followed by group refinement)

What you will need

- spinach
- nori seaweed
- ethanol
- acetone
- chromatography paper
- test tubes
- rubber stoppers
- cotton gauze
- mortar and pestle
- filter funnel
- dropping pipette

What you need to do

Planning

- (a) Initially working on your own, complete the 'Planning' questions on the *Investigation worksheet*. You will be given 20 minutes of class time to do this. You need to show this to your teacher before the next step.
- (b) Working in your group, discuss your individual planning and refine your ideas through group discussion. Each member of the group will need to submit the revised answers to the 'Planning' questions.

Carrying out of experiment

1. Extract the chlorophyll

Dry 3–5 spinach leaves overnight in a dry location at room temperature or in an oven at 45–50°C for 2–3 hours. Ensure the leaves are completely dry and brittle before continuing.

Tear the dried spinach leaves into small pieces, place in the pestle and add just enough ethanol to cover the spinach and then grind. Carefully pour the liquid through the cotton gauze in the funnel into a test tube. Insert a stopper and label the test tube.

Clean the mortar and pestle before treating the seaweed.

Cut the dry seaweed into small pieces and repeat the grinding procedure.

You will need to carry out the steps described below in ‘Paper chromatography’ for the spinach leaf extract and the seaweed extract.

2. Paper chromatography

- (a) Cut a strip of chromatography paper so that it will fit into a 2 cm diameter test tube.
- (b) Use a pencil to rule a line about 2 cm from one end of the paper.
- (c) Use a dropping pipette to take some of the liquid extract from its test tube. Apply the liquid along the pencil line on the chromatography paper. Try to keep the line of liquid as thin as possible. Allow the extract to dry, and repeat this application two or three times.
- (d) Pour about 1 cm of acetone into a 2 cm diameter test tube. It is important that the volume of acetone in the test tube remain below the line of liquid extract on the strip of chromatography paper when it is placed in the test tube.
- (e) With the line of liquid extract at the lower end, attach the chromatography paper to the centre of the stopper using a pin or paperclip. Lower the paper into the test tube and insert the stopper into the test tube. Make sure that the liquid extract is not in the acetone.
- (f) Allow the solvent to travel up the paper. Do not let the solvent run all the way to the top of the chromatography paper. Remove the chromatography paper when the solvent front is about 1 cm from the top of the paper. Mark the solvent front and the position of each band with a pencil and record the colour of each band.

Processing the data and Evaluation

- (a) Initially working on your own, complete the ‘Data processing and analysis’ and ‘Evaluation’ questions on the *Investigation worksheet*. You will be given class time to do this. You need to show this to your teacher before the next step.
- (b) Working in your group, discuss your individual data processing and analysis and evaluation and refine your ideas through group discussion. Each member of the group will need to submit the revised answers to the ‘Data processing and analysis’ and ‘Evaluation’ questions.

What you need to submit

At the end of the investigation, you need to submit your individual *Investigation worksheet* and the final refined *Investigation worksheet* based on the group discussions. Label clearly which is the individual and which is the refined *Investigation worksheet*.

Investigation worksheet**Planning**

What is the aim of your investigation?

Write a hypothesis for the experiment.

Predict what you think will happen.

What variables may affect the phenomenon you are investigating?

Which variable are you going to measure?

What steps have been taken to ensure that this is a fair test?

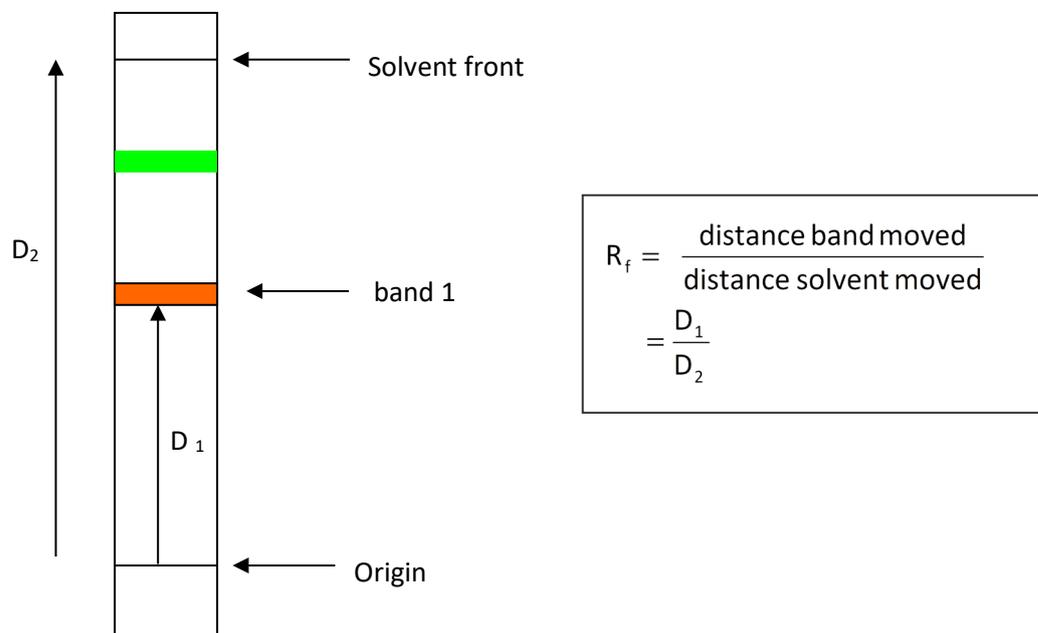
Collect and record the data you need

Draw your labelled chromatographs on this page. If you wish, you may photograph the chromatographs, print the photographs and paste them to the report. The photographs should be labelled.

Data processing and analysis

Data processing

You need to calculate the R_f values for each band on the chromatography paper. The R_f value is the ratio of the distance the coloured band has moved to the distance that the solvent front has moved.



Calculate the R_f values for each band on the chromatography paper for the spinach leaf extract.

Calculate the R_f values for each band on the chromatography paper for the seaweed extract.

Data analysis

Are there any patterns or trends in your data?

Evaluation

Do the data support the hypothesis? Explain.

State a conclusion that relates to the aim and hypothesis.

Identify any sources of experimental error. Suggest how the experimental design may have been improved to reduce any errors. If you think no changes in experimental design are needed, explain why not.

How confident are you with your conclusions? How much uncertainty/error is associated with your data?

[Data Analysis and Evaluation questions adapted from: Hackling, M. W. (2005). *Working scientifically: Implementing and assessing open investigation work in science* (Rev. ed.) (Appendices 2 & 3: Planning and report worksheet for science investigations). Perth: Department of Education and Training, pp. 27–38.]

Marking key for sample assessment task 1 – Unit 1

Description	Possible mark
Planning <ul style="list-style-type: none"> individual planning questions refined planning questions from group discussion 	2 2
Carrying out of experiment <ul style="list-style-type: none"> safely conducted use of repeat trials chromatograms drawn/photographed and labelled (data recording) equipment cleaned and returned appropriately 	1 1 2 1
Sighting of individual processing and data analysis, and evaluation before group refinement	2
Processing and analysis of data <ul style="list-style-type: none"> R_f values correctly calculated R_f values averaged for repeat trials patterns in data identified 	2 1 1
Evaluation <ul style="list-style-type: none"> makes a valid statement relating hypothesis to results states a conclusion related to aim and hypothesis identifies possible limitations in the experimental design suggests possible improvements or justifies lack of need for changes to experimental design statement about confidence in conclusion with supporting reasons 	2 1 1 1 2
Total	/22

Sample assessment task

Chemistry – General Year 11

Task 5 – Unit 1

Assessment type: Test**Conditions**

Time for the task: 50 minutes

Task weighting

7% of the school mark for this pair of units

TEST**The Atomic Structure, Language of Chemistry and Chemical reactions****Recommended time:** 50 minutes**Structure of the test:**

Section	Suggested working time	Number of questions	Marks
ONE Multiple-choice	15 minutes	10	10
TWO Short response	35 minutes	6	23
		Total	33

Use the periodic table provided.

PLEASE DO NOT OPEN THE TEST UNTIL INSTRUCTED TO DO SO

Section One: Multiple-choice questions

Choose the correct answer from the choices offered.

1. In the 'gold foil experiment' used to help work out the structure of the atom, positively-charged alpha particles were fired at a thin gold foil. Most alpha particles went through the gold unaffected; a small number were deflected from their path; and an even smaller number were reflected back in the general direction from which they came.

Consider the following three statements in relation to these observations.

- (I) The gold atoms have a small, dense region of matter within them.
(II) Most of the gold atoms are empty space.
(III) The electrons within gold atoms are large compared with the size of the nucleus.

Which of the statements above are reasonable conclusions that can be made from these observations?

- (a) I only
(b) II only
(c) III only
(d) I and II only
2. Which one of the following determines to which element an atom belongs?
- (a) its number of protons
(b) its number of neutrons
(c) its number of electrons
(d) its mass number

3. Which of the diagrams below best represents an element?



(a)



(b)



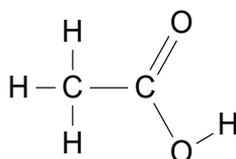
(c)



(d)

4. Which one of the following is evidence for the existence of ions?
- (a) Ionic compounds are usually brittle.
(b) Ions in water can conduct an electric current.
(c) Ionic compounds are usually solid at room temperature.
(d) Ionic compounds are usually soluble in water.
5. Which one of the following statements about the calcium ion which has a charge of positive two (+2) (symbol Ca^{2+}) is correct?
- (a) The calcium atom has gained two protons to form the calcium ion.
(b) The calcium atom has lost two protons to form the calcium ion.
(c) The calcium atom has lost two electrons to form the calcium ion.
(d) The calcium atom has gained two electrons to form the calcium ion.

6. Cu is the symbol for
- (a) an element.
 - (b) a compound.
 - (c) a molecule.
 - (d) an ion.
7. Which one of the following statements about nitric acid, chemical formula HNO_3 , is true?
- (a) Nitric acid is an element.
 - (b) Nitric acid contains two different elements.
 - (c) There are more oxygen atoms than hydrogen atoms in nitric acid.
 - (d) There are more nitrogen atoms than hydrogen atoms in nitric acid.
8. The structure of a molecule of acetic acid, the compound that makes vinegar taste sour, can be represented as shown below. Each H, C and O represents one atom of hydrogen, carbon and oxygen, respectively.



- The number of atoms of each element in one molecule of acetic acid is
- (a) one hydrogen, one carbon and one oxygen.
 - (b) two hydrogen, two carbon and two oxygen.
 - (c) three hydrogen, two carbon and two oxygen.
 - (d) four hydrogen, two carbon and two oxygen.
9. Which one of the following does **not** involve a chemical reaction?
- (a) petrol burns to release carbon dioxide and water
 - (b) water is boiled to form steam
 - (c) rust forms on the surface of an iron nail
 - (d) acid rain dissolves a limestone statue
10. The incomplete equation below is for the reaction between hydrochloric acid and limestone (calcium carbonate).



The total number of atoms of the **products** of this reaction is

- (a) 3.
- (b) 5.
- (c) 7.
- (d) 9.

Section Two: Short answer**(23 marks)**

Write your answers in the space provided on the paper. Where answers require a calculation, working must be shown to obtain full marks.

1. Complete the following table by writing the name or symbol, as appropriate, for these common elements.

Name of element	Symbol of element
Nitrogen	
	Cl
	Fe
Sulfur	

(4 marks)

2. Oxygen can exist in the form of diatomic molecules, O_2 , and as the oxide ion, O^{2-} . Describe the differences between these two forms of oxygen. As part of your answer, comment on the ratio of electrons to protons in O_2 , the ratio of electrons to protons in O^{2-} , and how the ion is formed.

(4 marks)

3. Methane gas burns in oxygen gas to produce water and carbon dioxide. The reaction can be represented by the (unbalanced) equation shown below.

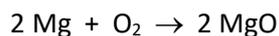


If one such reaction is carried out where five carbon atoms and 20 hydrogen atoms from the methane and 20 oxygen atoms from the oxygen gas are reacted, how many of each type of atom will be present in the products, water and carbon dioxide? Complete the table below to answer the question.

Number of carbon atoms in product	Number of hydrogen atoms in product	Number of oxygen atoms in product

(3 marks)

4. Magnesium burns in air with a very bright, white flame and is used in flares. The reaction can be represented by the equation below.

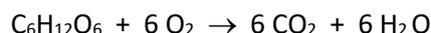


When 24 g of magnesium burns in air, 40 g of magnesium oxide is produced. What mass of oxygen was consumed in the reaction?

Show how you worked out the answer.

(2 marks)

5. Respiration is the process by which glucose ($C_6H_{12}O_6$) reacts with oxygen in cells in our body to produce energy as well as carbon dioxide and water. The equation for respiration is



If 45 g of glucose combines with 48 g of oxygen to produce 66 g of carbon dioxide, what mass of water is also produced?

Show how you worked out the answer.

(2 marks)

6. Superphosphate is an important agricultural fertiliser. It is typically a mixture of two compounds – calcium dihydrogenphosphate and calcium sulfate. Below is the description for its production.

‘Calcium fluorapatite, contained in rock phosphate, reacts with sulfuric acid and water to produce calcium dihydrogenphosphate, calcium sulfate and hydrogen fluoride.’

- (a) Write the word equation for the reaction to produce superphosphate from this description.

(2 marks)

Sulfuric acid used in the manufacture of superphosphate is made in **three** steps.

Step 1 – Sulfur is burnt with oxygen to produce sulfur dioxide

- (b) Complete the word equation for the reaction occurring in Step 1.



(2 marks)

Step 2 – The word equation for Step 2 is as follows:



(c) Write a description for the reaction occurring in Step 2.

(2 marks)

Step 3 – Sulfur trioxide is reacted with water to form sulfuric acid

(d) Write the word equation for the reaction occurring in Step 3.



(2 marks)

END OF TEST

Marking key for sample assessment task 5 – Unit 1

Section 1: Multiple-choice questions

Question number	Answer
1	D
2	A
3	B
4	B
5	C
6	A
7	C
8	D
9	B
10	C

Section 2: Short answer

(23 marks)

Write your answers in the space provide on the paper. Where answers require a calculation, working must be shown to obtain full marks.

- Complete the following table by writing the name or symbol, as appropriate, for these common elements.

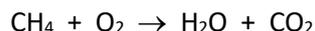
Name of element	Symbol of element
Nitrogen	N
Chlorine	Cl
Iron	Fe
Sulfur	S

Description	Possible mark
1 mark each symbol or name	4
Total	/4

- Oxygen can exist in the form of diatomic molecules, O_2 , and as the oxide ion, O^{2-} . Describe the differences between these two forms of oxygen. As part of your answer, comment on the ratio of electrons to protons in O_2 , the ratio of electrons to protons in O^{2-} , and how the ion is formed.

Description	Possible mark
Recognition that O_2 is two atoms chemically joined behaving as a single unit	1
Recognition that the number of protons and electrons are equal in O_2	1
Recognition that the oxide ion is formed by the oxygen atom gaining electrons	1
Recognition that the oxide ion has two more electrons than protons	1
Total	/4

3. Methane gas burns in oxygen gas to produce water and carbon dioxide. The reaction can be represented by the (unbalanced) equation shown below.

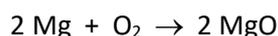


If one such reaction is carried out where five carbon atoms and 20 hydrogen atoms from the methane and 20 oxygen atoms from the oxygen gas are reacted, how many of each type of atom will be present in the products, water and carbon dioxide? Complete the table below to answer the question.

Number of carbon atoms in product	Number of hydrogen atoms in product	Number of oxygen atoms in product
5	20	20

Description	Possible mark
1 mark for number of atoms for each element	3
Total	/3

4. Magnesium burns in air with a very bright, white flame and is used in flares. The reaction can be represented by the equation below.

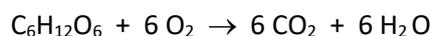


When 24 g of magnesium burns in air 40 g of magnesium oxide is produced. What mass of oxygen was consumed in the reaction?

Show how you worked out the answer.

Description	Possible mark
Mass of magnesium + mass of oxygen = mass of magnesium oxide	1
Mass of oxygen = 40 – mass of magnesium = 40 – 24 = 16 g	1
Total	/2

5. Respiration is the process by which glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) reacts with oxygen in cells in our body to produce energy as well as carbon dioxide and water. The equation for respiration is



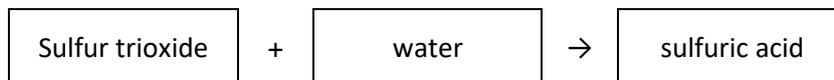
If 45 g of glucose combines with 48 g of oxygen to produce 66 g of carbon dioxide, what mass of water is also produced?

Show how you worked out the answer.

Description	Possible mark
Mass of glucose + mass of oxygen = 93 g	1
Mass of water = 93 – mass of carbon dioxide = 93 – 66 = 27 g	1
Total	/2

Step 3 – Sulfur trioxide is reacted with water to form sulfuric acid

(d) Write the word equation for the reaction occurring in Step 3.



Description	Possible mark
One mark for reactants	1
One mark for product	1
Total	/2

Sample assessment task

Chemistry – General Year 11

Task 9 – Unit 2

Assessment type: Extended response

Conditions

Period allowed for completion of the task: three weeks

A combination of in-class and out-of-class time will be required to complete this activity.

Task weighting

7% of the school mark for this pair of units

Note: Context of assessment task is agricultural chemistry

Soil pH

28 marks

The pH of soils has an important influence on the growth and health of plants. A range of natural factors influence soil pH. Agricultural chemicals affect soil pH, thus there is a need to monitor and manage soil pH in agricultural settings.

Natural factors influencing soil pH include

- parent minerals
- rainfall, temperature and climate
- organisms
- organic matter.

Research and report on the following questions related to soil pH.

1. Explain how each of the natural factors listed above affect soil pH. You should aim for about half a page on each factor.
2. Explain how nitrogen-based fertilisers and phosphate fertilisers affect soil pH.
3. Describe and explain how the health of a plant may be affected by a soil pH that is too
 - (a) high
 - (b) low.
4. In an agricultural setting, describe and explain how a soil with too
 - (a) high a pH may be reduced
 - (b) low a pH may be increased.

Note: Your answers need to address the chemistry of how the factor affects pH.

Referencing

You need to use at least **three (3)** sources of information in your research. These sources must be clearly identified to enable their verification. Web-based sources need to be used with care to ensure the data is accurate. Where web-based sources are used, give the html address, the date accessed and, ideally, the author and/or publisher of the website.

Marking key for sample assessment task 9 – Unit 2

Description	Possible mark
Explanation of how natural factors affect soil pH (2 marks for each factor) <ul style="list-style-type: none"> parent minerals rainfall, temperature and climate organisms organic matter 	8
Explanation of how nitrogen-based fertilisers affect soil pH <ul style="list-style-type: none"> recognition of whether the fertiliser increases or decreases the soil pH explanation of how the fertiliser changes soil pH 	1 2
Explanation of how phosphate fertilisers affect soil pH <ul style="list-style-type: none"> recognition of whether the fertiliser increases or decreases the soil pH explanation of how the fertiliser changes soil pH 	1 2
Description and explanation of how the health of a plant may be affected by a soil pH that is too high	2
Description and explanation of how the health of a plant may be affected by a soil pH that is too low	2
Description of how a soil with too high a pH may be reduced <ul style="list-style-type: none"> recognition of substance(s) that can be added to soil to reduce pH explanation of how substance alters pH 	1 2
Description of how a soil with too low a pH may be increased <ul style="list-style-type: none"> recognition of substance(s) that can be added to soil to increase pH explanation of how substance alters pH 	1 2
Referencing <ul style="list-style-type: none"> at least three sources – one mark each up to a maximum of three marks clear referencing allowing verification 	3 1
Total	/28