

Year 12 Chemistry

Acids & Bases Depth Study Task 2024

TOPIC: Depth Study – Acids & Bases	MARKS: / 28
SUBMISSION REQUIREMENTS: The investigation will be due in Week 8, Tuesday 19 th March 2024 on Canvas.	WEIGHTING: 25%
OUTCOMES TO BE ASSESSED: CH12-1: Develops and evaluates questions and hypotheses for scientific investigation. CH12-2: Designs and evaluates investigations in order to obtain primary and secondary data and information. CH12-3: Conducts investigations to collect valid and reliable primary and secondary data and information. CH12-7: Communicates scientific understanding using suitable language and terminology for a specific audience or purpose. CH12-13: Describes, explains and quantitatively analyses acids and bases using contemporary models.	
DIRECTIONAL VERBS: <i>Analyse - Identify components and the relationship between them; draw out and relate Implications</i> <i>Conduct – to organise or carry out.</i> <i>Communicate - Share or exchange information, news, or ideas</i> <i>Design – to do or plan (something) with a specific purpose in mind.</i> <i>Develop -to set make clear (something) in detail</i> <i>Explain - Relate cause and effect; make the relationships between things evident; provide why and/or how</i> <i>Evaluate - Make a judgement based on criteria; determine the value of.</i>	

TASK DESCRIPTION:

Inquiry questions: How are solutions of acids and bases analysed?

There are many different plants that are sources of dyes that act as acid-base indicators. Anthocyanins are a class of organic compounds found in many plants including red cabbage, red onion, blueberries, red grapes and violet leaves that change colour in the presence of acids and bases. Other natural sources of acid-base indicators include hydrangea, geranium, petunia and red rose petals, and turmeric.

Students are to research the use of natural indicators in order to **design** an investigation to answer the following aim of their investigation:

To determine which natural pigments can be used as natural indicators to distinguish between acidic, neutral and basic solutions

Students will then **conduct** an investigation where they will prepare 5 potential natural indicators, and test whether they can distinguish between acidic, neutral and basic solutions.

Students will **explain** how equilibrium systems relate to the development and use of indicators, including natural indicators. Students will then **analyse** their secondary research on indicators, and the results of their first hand investigation, in order to **communicate** the information in a scientific report.

Note: Students will have time in class to complete the practical component of this task on the following dates:

Week 6 Tuesday 5/3 Period 2 (Lab 18)

Week 6 Friday 8/3 Period 2 (Lab 18)

Week 7 Mon 11/3 Period 4 (Lab 18)

Further lessons can be arranged by discussion with your teacher.

Submission of a draft report is encouraged and in accordance with the Student Draft Procedure.

ASSESSMENT CRITERIA:

Scientific Report (25 marks)

Students are to research five types of natural indicators in order to gain primary data on their effectiveness as a pH indicator.

Prior to conducting the experiment, students will be required to research what natural indicators are currently known and their expected results for determining if a substance is acidic, neutral or basic.

*Students will then select five different types of natural indicators and **conduct** an investigation on known samples of acidic, neutral and basic substance to evaluate the claim of their effectiveness as natural indicators.*

*Student will need to **develop** their aim, hypothesis, equipment as well as **design** an appropriate method to use.*

*They will **analyse** results of their investigation alongside secondary data gained from academic papers, including **explaining** the changes in colour that were observed.*

*They will need to also need to **evaluate** their experiment's reliability and validity.*

Students will need to communicate the above using the standard conventions of a scientific report, including academic referencing style.

Scientific Report Scaffold

Section	Notes	Marks
Aim:	Link this to the claim you are evaluating	1
Hypothesis:	Estimate the colour changes at you expect to observe when you're testing each of your five indicators under different pH conditions	1
Equipment:	Outline the 5 natural indicators you will test and the equipment you will require	2
Method:	Outline the procedure you will use for your testing to ensure you attain your results in an efficient and effective manner	4
Results:	Tabulated data of each chemical indicator.	4

Discussion:	<ul style="list-style-type: none"> - Detailed review of your primary data - A detailed account of the chemical nature of the substance - An explanation on how equilibrium systems relate to the use of indicators, including natural indicators. - Discussion of relevant scientific journal articles and what their academic results indicate. - Discussion of the validity and reliability of the testing procedure used 	15
Conclusion	<ul style="list-style-type: none"> - Summary statement 	1

Below are some websites may be of assistance to look at to get you started.

<https://www.compoundchem.com/2017/05/18/red-cabbage/>

<https://www.compoundchem.com/2014/12/02/poinsettia/>

<https://antoine.frostburg.edu/chem/senese/101/acidbase/faq/household-indicators.shtml>

SCIENTIFIC REPORT	Mark
AIM (CH12-1)	
<i>Aim correctly describes the purpose of the investigation using correct scientific language conventions.</i>	1
HYPOTHESIS (CH12-1)	
<i>Hypothesis predicts the colour changes that will be observed for the indicators when immersed in acidic, neutral and basic samples.</i>	1
EQUIPMENT (CH12-2)	
<i>Equipment list provided in comprehensive and includes all chemicals, indicators and equipment used.</i>	2
<i>Equipment list provided lacks some of the chemicals, indicators and equipment used.</i>	1
METHOD (CH12-2, CH12-7)	
<i>Method comprehensively describes each step conducted in detail, providing volumes of liquids used, masses of samples, in a manner that follows scientific conventions, is step-by-step, with multiple repeated testing and clearly has the investigation's validity factored in all .</i>	4
<i>Method describes each step conducted, including most of the volumes of liquids used and masses of samples, with repeated tests, in a manner that follows scientific conventions, is step-by-step and concise.</i>	3
<i>Method describes most steps conducted, providing some volumes of liquids used and masses of samples, in a manner that follows most scientific conventions.</i>	2
<i>Method lacks clear instructions, it describes briefly some steps without following scientific conventions.</i>	1
RESULTS (CH12-3)	
<i>Results table includes all five indicators, multiple repeated testing results of acidic, neutral and basic substances, headings, all test results provided alongside pH measurements.</i>	4

<p><i>Results table includes all five indicators, repeated test results of acidic, neutral and basic substances, headings, all test results provided, however doesn't include pH measurements.</i></p>	3
<p><i>Table contains a heading, provides repeated test results for 3-4 indicators for acidic, neutral and basic substances.</i></p> <p style="text-align: center;"><i>or</i></p> <p><i>Table contains a heading, provides repeated test results all five but lacks the testing for acidic, neutral and basic substances.</i></p>	2
<p><i>Limited results tabulated, lacking significant details, no repeated test results, minimal indicators tested, or only test for acidic, neutral or basic substances.</i></p>	1
<p>DISCUSSION (CH12-3, CH12-7, CH12-13)</p>	
<p><i>Discussion comprehensively analyses the results of their investigation, discussing both their own measurement and comparing them to secondary data sources, including those gained from academic papers. It includes an explanation of the mechanism behind the changes in colour that were observed, with the coloured compound's structural formula displayed and the equilibrium reaction described. It also includes an evaluation their experiment's reliability and validity. Information is communicated using the standard conventions of a scientific report, including academic referencing.</i></p>	13-15
<p><i>Discussion analyses the results of their investigation, discussing both their own measurement and comparing them to any secondary data sources, which may include some reference to academic papers. It includes an explanation of the mechanism behind the changes in colour that were observed which has some minor error, including the coloured compound's structural formula displayed and the equilibrium reaction described, with minor errors. It has an evaluation of their experiment's reliability and validity but may neglect minor aspects of this. It has communicate the above using the standard conventions of a scientific report, including academic referencing with minor errors.</i></p>	10-12
<p><i>Discussion analyses the results of their investigation, discussing both their own measurement and making limited reference to secondary data sources. It includes a brief explanation of the mechanism behind the changes in colour that were observed, with the coloured compound's structural formula displayed or the equilibrium reaction described. It also includes an evaluation their experiment's reliability or validity. It has communicated the above using most standard</i></p>	7-9

<i>conventions of a scientific report, including academic referencing with errors.</i>	
<ul style="list-style-type: none"> <i>Discussion briefly analyses the results of their investigation, discussing only their own measurement or a secondary data source. It may include an explanation of the mechanism behind the changes in colour that were observed or provides the coloured compound's structural formula displayed or the equilibrium reaction described. It neglects most aspects of their experiment's reliability and validity. It has communicated the above using the some standard conventions of a scientific report, without academic referencing.</i> 	4-6
<ul style="list-style-type: none"> <i>Discussion interprets some aspects of the results, with no consultation of any secondary sources</i> 	1-3
CONCLUSION (CH12-13)	
<ul style="list-style-type: none"> <i>Conclusion concisely summarises the results for the indicators tested compared to the expected results.</i> 	1

Outcome	Marks
CH12-1	/ 2
CH2-2	/ 6
CH12-3	/ 19
CH12-7	/ 19
CH12-13	/ 16