Section 3

Cleaning Skin
### 9.3 Lifestyle Chemistry – Section 3 :::: Cleaning Skin

<table>
<thead>
<tr>
<th>9.2.3.a</th>
<th>Identify the role of the skin as</th>
</tr>
</thead>
<tbody>
<tr>
<td>– An organ to separate the body from the external environment</td>
<td></td>
</tr>
<tr>
<td>– an organ assisting in body temperature control</td>
<td></td>
</tr>
<tr>
<td>– an organ to protect against entry by disease-causing organisms</td>
<td></td>
</tr>
</tbody>
</table>

| 9.2.3.b | Define the term microflora and discuss the role of the microflora on skin in different parts of the body |

| 9.2.3.c | Discuss the term pH in terms of its ability to describe the acidity of a substance |

<table>
<thead>
<tr>
<th>9.2.3.d</th>
<th>Explain the relationship between the natural pH of the skin and</th>
</tr>
</thead>
<tbody>
<tr>
<td>– the action of micro flora</td>
<td></td>
</tr>
<tr>
<td>– natural oil produced by glands in the skin</td>
<td></td>
</tr>
<tr>
<td>– perspiration</td>
<td></td>
</tr>
</tbody>
</table>

| 9.2.3.e | Identify and explain the use of common components of body soaps, cleansers and shampoos and the reason for their use |

| 9.2.3.i | Perform a first-hand investigation to examine prepared slides of human skin |

| 9.2.3.ii | Perform first-hand investigations to measure the pH values of a range of skin and hair products |

| 9.2.3.iii | Identify data sources, plan, choose equipment or resources for, and perform a first-hand investigation to test manufacturers’ claim(s) on a commercial product such as soap, shampoo or shower gel and use the available evidence to analyse the results and discuss the validity of the claim(s) |
9.2.3.i Perform a first-hand investigation to examine prepared slides of human skin

What to do

Examine some prepared slides of human skin

Diagram Structures in the Human Skin

- 94 oil glands
- 60 hairs
- 19,000,000 cells
- 12 heat receptors
- 12 cold receptors
- 1250 pain receptors
- 165 pressure receptors
- 2.5 square centimetres of skin contains
- 6 metres of blood vessels
- 625 sweat glands
- 19,000 sensory cells
- 25 metres of nerves
Identify the role of the skin as
- an organ to separate the body from the external environment
- an organ assisting in body temperature control
- an organ to protect against entry by disease-causing organisms

The Skin and its functions

The skin covers the body and encloses all the other organs. It is the largest organ in the body. The total skin area of an average adult is 1.8 square metres and it weighs about 12.5 kg.

The skin has a number of roles.

1. It separates the body from the external environment.
   - Skin is almost completely waterproof
   - Skin protects the inside of your body from chemicals and
   - Skin protects the body from the harmful radiation from the sun.

2. It protects the body from entry of disease causing organisms.
   Unbroken skin is a barrier that successfully blocks the entry of organisms and other substances.

3. It acts as an secretory organ (although some texts say excretory organ)
   The body releases water and other waste products through the skin.

4. It helps maintain constant body temperature.
   - Human body temperature is maintained at 37°C.
   - When the body temperature rises there is increased blood flow to the skin surface. The blood loses its heat to the surrounding air. This cools the body
   - When body temperature decreases, there is reduced blood flow to the skin surface. The blood has less chance of losing heat to the surrounding air. The body keeps its heat.
   - The skin contains thousands of sweat glands. A heat regulation centre in the brain controls these glands. When body temperature rises sweat is produced which flows onto the skin. When the water in sweat evaporates, the body cools. This helps control body temperature.

5. As well the skin detects hot and cold temperatures, pain, pressure and movement and forms vitamin D in sunlight.
Notes Questions

1. The diagram opposite shows a 2.5 square centimeter square.
   a. How many hairs occur on a 2.5 square centimeter of skin?
   b. How many sweat glands occur on a 2.5 square centimeter of skin?
   c. How many cells occur on a 2.5 square centimeter of skin?

2. Name the largest organ in the body.
3. Can water pass through the skin?
4. Explain why the skin is a secretory organ?
5. What vitamin is produced by the skin?
6. Name one function of the skin.
The pH scale

The pH scale is a measure of acidity or alkalinity - i.e. the strength of an acid or a base.

The pH scale ranges from 0 to 14.
- A pH of less than 7 indicates an acid.
- The lower the pH, the more acidic it is.
- Litmus turns red in acid
- A pH of more than 7 indicates a base (alkali)
- The higher the pH the more basic it is.
- Litmus turns blue in alkalis
- A pH of 7 indicates a neutral substance – neither an acid nor a base.
- Pure water has a pH of 7.

### pH of common substances

<table>
<thead>
<tr>
<th>pH</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Lye</td>
</tr>
<tr>
<td>13</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Washing soda</td>
</tr>
<tr>
<td>11</td>
<td>Household ammonia</td>
</tr>
<tr>
<td>10</td>
<td>Limewater</td>
</tr>
<tr>
<td>9</td>
<td>Shampoo, Sea water, Baking soda</td>
</tr>
<tr>
<td>8</td>
<td>Blood</td>
</tr>
<tr>
<td>7</td>
<td>Pure water</td>
</tr>
<tr>
<td>6</td>
<td>Urine</td>
</tr>
<tr>
<td>5</td>
<td>Black coffee</td>
</tr>
<tr>
<td>4</td>
<td>Tomato juice</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Vinegar</td>
</tr>
<tr>
<td>1</td>
<td>Lemon juice</td>
</tr>
</tbody>
</table>

Notes Questions

7. Read the following statements. Decide if they are True or False.

  a. A neutral substance has a pH of 7
  b. Salt water is a neutral substance
  c. Lye is the most acidic substance in the table above
  d. Lemon juice is the least acidic substance in the table above
  e. The pH range of an acid is 7 – 14.
  f. Acidic or alkaline substances cannot be used on your skin
  g. Your health will suffer if you drink acidic or alkaline substances
  h. An alkali has a higher pH than an acid.
  i. Black coffee is more acidic than vinegar.
  j. Soap is more acidic than vinegar.
9.2.3.ii Perform first-hand investigations to measure the pH values of a range of skin and hair products

**Background information**

The table below has data that lists pH values in soaps and soap alternatives.

<table>
<thead>
<tr>
<th>Product</th>
<th>pH</th>
<th>Product</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sebitar (Ego)</td>
<td>6.0</td>
<td>Sapoderm medicated</td>
<td>10.7</td>
</tr>
<tr>
<td>Neutrogenic normal</td>
<td>9.5</td>
<td>Steifel Polytar</td>
<td>10.8</td>
</tr>
<tr>
<td>Lux</td>
<td>10.6</td>
<td>Gamophen medicated</td>
<td>11.1</td>
</tr>
<tr>
<td>Cussons Pearl</td>
<td>10.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cussons Baby Soap</td>
<td>10.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pears Transparent</td>
<td>10.8</td>
<td>Softly Washing Powder</td>
<td>6.5</td>
</tr>
<tr>
<td>Cussons Imperial Leather</td>
<td>10.9</td>
<td>Palmolive Dishwashing liquid</td>
<td>7.4</td>
</tr>
<tr>
<td>J &amp; J Baby Soap</td>
<td>11.0</td>
<td>Trix Dishwashing liquid</td>
<td>7.8</td>
</tr>
<tr>
<td>Steifel Lioatum Bar</td>
<td>11.0</td>
<td>Solvol Soap</td>
<td>10.6</td>
</tr>
<tr>
<td>Simple Soap</td>
<td>11.2</td>
<td>Surf Washing Powder</td>
<td>11.4</td>
</tr>
</tbody>
</table>

The graph below has data that lists pH values in soaps and soap alternatives.

<table>
<thead>
<tr>
<th>Product</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sebitar 5.5</td>
<td></td>
</tr>
<tr>
<td>SebiRinse 5.5</td>
<td></td>
</tr>
<tr>
<td>Pinetarsol Bar 6.0</td>
<td></td>
</tr>
<tr>
<td>Pinetarsol Gel 6.0</td>
<td></td>
</tr>
<tr>
<td>QV Wash 6.0</td>
<td></td>
</tr>
<tr>
<td>QV Bar 6.0</td>
<td></td>
</tr>
<tr>
<td>HairScience Shampoo 6.0</td>
<td></td>
</tr>
<tr>
<td>HairScience Conditioner 6.0</td>
<td></td>
</tr>
<tr>
<td>Pinetarsol Solution 6.5</td>
<td></td>
</tr>
<tr>
<td>Palmolive Dish washing Liquid</td>
<td>7.4</td>
</tr>
<tr>
<td>Neutrogena 9.5</td>
<td></td>
</tr>
<tr>
<td>Simple soap 11.2</td>
<td></td>
</tr>
<tr>
<td>Gamophen Medicated 11.1</td>
<td></td>
</tr>
<tr>
<td>J&amp;J Baby soap 11.0</td>
<td></td>
</tr>
<tr>
<td>Palmolive 11.0</td>
<td></td>
</tr>
<tr>
<td>Cusson’s Imperial Leather 10.9</td>
<td></td>
</tr>
<tr>
<td>Sapoderm 10.8</td>
<td></td>
</tr>
<tr>
<td>Pear’s Transparent 10.8</td>
<td></td>
</tr>
<tr>
<td>Steifel Polytar 10.8</td>
<td></td>
</tr>
</tbody>
</table>

**Notes Questions**

8. Identify the pH of two soaps.  [1 mark]
9. Describe the information in the table.  [3 marks]
10. Write a conclusion based on data recorded in the graph and table.  [2 marks]
11. Discuss which form – graph or table - is the best.  [3 marks]
Activity 3-1  pH for Skin & Hair Products

Aim  To attempt to measure the pH of oil, a saline (salty) water solution, distilled water, an acid and an alkali and a variety of skin and hair products

Method
1. Collect samples of an oil, a saline (salty) water solution, distilled water, an acid and an alkali and a variety of skin and hair products.
2. Add small quantities of each substance to an appropriate quantity of water.
3. Measure the pH using litmus paper, universal indicator (and a pH meter).
   NB Be careful using a pH meter – it can be damaged when testing oil & other products.
4. Repeat the pH measurement at least three times for each substance.
5. Record your results [in a table].

VGCMANS - In this experiment:
- the independent variable is the type of substance.
- the dependent variable is the pH value.
- Using an indicator from the same batch is one variable that should be held constant.
- The experimental groups (which usually relate to the independent variable) are the various types of substances. The control group is distilled water.
- pH is being measured. In many investigations the important measurement is measurement of the dependent variable. Sometimes it needs to be recognized that measurement is difficult and may not be possible with available equipment.
- the activity is a practical investigation
- the experiment or measurements need to be repeated several times (number).
- the results should be reliable because the substances are tested several times.
- the activity should be valid because variables were kept constant, different indicators were used and the experiment was repeated several times to ensure reliability.

Discussion Questions
1. Describe any problems with measuring the pH.

Marking criteria for Quick Practical  [10 marks]

Syllabus Outcome – H12.1  Perform first-hand investigation
1. Minimizing wastage of resources when doing practical  [2]
2. Using safe work practices  [2]

Syllabus Outcome – H12.2  Gather information
3. Record results (table)  [5]

Syllabus Outcome – H13  Present information
4. Use Laboratory scaffold  [1]
9.2.3.b Define the term microflora and discuss the role of the microflora on skin in different parts of the body

Skin microflora

Microflora refers to microscopic organisms such as bacteria, fungi, protozoa and viruses. For the human body the term microflora refers to the microorganisms that live on or in the body – there are hundreds of different types of microorganisms. Very favourable conditions tend to be in the more moist areas - under your armpits and external sex organs. The skin, areas such as the mouth, nasal cavity and throat, and the large intestine also have large numbers of microorganisms. For example, the skin contains 2.4 million microorganisms per square centimetre (or from another source - there are about 10 000 microbes per square centimetre of skin). On the other hand areas such as deep tissues, blood and the nervous system have few if any microorganisms in normal circumstances.

The microorganisms (mostly bacteria) feed on sweat. It is interesting to note that sweat does not smell. The smell is a by-product produced by the bacteria as it feeds on the sweat. This is why these moist areas can get smelly.

It is important that we do not destroy these microorganisms, just because they cause smells. Most microorganisms are beneficial – helpful or important for the survival of humans. There are also harmful microflora (pathogenic – disease causing). Two roles of helpful bacteria are

♥ to keep the numbers of harmful bacteria in check. They do this by occupying the skin space, leaving little or no room for harmful bacteria to reproduce and grow and
♥ to produce acids that lower the skin pH. Many disease causing microflora do not survive well in a low pH environment.

In healthy people there is a balance between the normal microflora and the conditions that exist in particular parts of the body. Under normal conditions, the skin is an effective physical and chemical barrier to invasion by harmful microorganisms. The unbroken skin provides the physical barrier. An acid coating provides the chemical barrier. This coating (or acid mantle) is the result of a mixture of natural oils, called sebum, and sweat. The natural oils are supplied to the skin by glands. Both the oil and the sweat are slightly acid. A population of helpful micro flora can survive very well in these normal skin conditions. Disease conditions may result if this balance is disturbed. Disturbances include changes in diet, use of strong soaps, cuts or even stress.

An example of the beneficial role of bacteria is in the control of the disease thrush. The vagina is populated with beneficial lactobacilli. These bacteria secrete lactic acid that keeps the pH of the vagina low. This prevents the growth of more dangerous microbes that only survive at neutral pH. The fungus Candida albicans, that causes thrush, is
occasionally present in the vagina. The beneficial bacteria control the population of thrush fungi. A disturbance can occur when a person uses a broad-spectrum antibiotic to treat an infection. The antibiotic can destroy both beneficial and harmful bacteria. With the bacteria removed conditions could be just right for a rapid population explosion of fungi - resulting in thrush.

Both hair and skin need to be kept clean. Normal washing is usually sufficient and appropriate. However, soaps briefly remove the natural acid protection of the skin [Remember, the skin has a slightly acid pH (4.5 – 6.0). It’s this slight acidity that gives the skin its natural protection against certain bacteria and fungi]. Soaps are alkaline (pH 9.5 – 11) and therefore raise the pH. They also can dry and irritate the skin. The raised pH and the drying tend to destroy the skin microflora. Fortunately, for most people the skin pH returns to normal relatively quickly (as fast as 15 minutes for some). As well, the normal skin microflora also quickly returns to normal, since the normal washing of skin with soap and water never removes all microorganisms. This means the protective barrier provided by helpful skin microflora is quickly restored. The resistance of normal skin flora to removal from the skin is desirable since this population of flora helps keep pathogenic organisms in check.

This is not true for some people who suffer from eczema. These people normally tend to have a raised skin pH. It cannot easily return to an acid pH after washing with soap. The skin may remain in an alkaline state for a long time. Helpful skin microflora do not survive well in these alkaline conditions. This results in the skin being open to infection or irritation.

Problems with harmful micro-flora can occur around hair follicles, oil and sweat glands, as well as skin breaks (cuts, scratches). These are areas where the physical barrier provided by the skin can be broken. Antiseptic creams are used to help the skin protect the body from infection by harmful microflora. Surgeons need to ensure infection free skin. Strong germicides, such as betadine, and surgical scrubbing are used.

The products used on the hair and skin is designed to take into account body chemistry. **It is important that they do not destroy the balance of the microflora that survive on the skin.** People who suffer particular skin conditions need to be careful about the products they use. In some cases, chemicals such as soap, lanolin and perfumes that contain fixatives (causing irritation) should be avoided. A well-known company Ego Pharmaceuticals never uses lanolin or lanolin derivatives in any of their products.

**The microflora of the digestive system**

The low pH of stomach acids prevent normal microflora from living in the stomach. Some microbes do survive passage through the stomach to the intestines.

The pH and the presence of digestive enzymes in the small intestine keeps the number of normal bacteria fairly low.

Conditions in the large intestine favour the growth of normal microflora. Some of the normal bacteria that live in the large intestine are beneficial; they may produce vitamins, aid digestion, and prevent the outgrowth of dangerous bacteria. The large intestine has the largest population of microflora in the body.
Notes Questions

12. Complete the following sentences.
   a. The types of microflora found on the skin of humans include _____
   b. The number of microflora per square centimetre of skin is _____
   c. Parts of the body that support large numbers of microflora include _____
   d. Parts of the body that support very few microflora include _____
   e. Helpful microflora keep harmful microflora in check by occupying skin space and leaving little _____
   f. Many harmful microflora do not survive well because the skin has a low _____
   g. Harmful bacteria can cause _____
   h. The population of harmful bacteria can rapidly increase when _____ such as changes in diet or stress occur.
   i. Soaps briefly remove the natural _____
   j. For some people the skin pH remains in an alkaline state for _____
   k. Problems with harmful bacteria can occur around _____
   l. It is important that products used on the skin do not destroy the _____
   m. The stomach has very few microflora because of its low _____

13. Identify two roles of bacteria in the large intestine?
HSC Style Question

Discuss the role of the microflora on skin in different parts of the body

This question is unstructured and requires an extended answer

In order to answer such a question, you must provide some structure.

1. Identify (& highlight) the important words in the question
2. Recall definitions of these important words (if necessary)
   - Discuss – identify issues and provide points for and against
   - Role – What the microflora do
   - Different parts – where: outer skin; intestines
3. Plan an outline of your answer.
   - This plan must reflect the depth required (Verb & marks)
   - The table below shows a possible scaffold to answer a discuss question
   - The section “Skin microflora” provides most of the information required to answer the discussion question.
   - Research is needed to fully answer the different parts of the body.
   - Possible issues
     - Two types – helpful & harmful; and where they occur
     - Identify main roles of helpful microflora – keep numbers of harmful in check. Give example eg Thrush
     - Role in large intestine
     - Maintaining balance & preventing disturbances (microflora increase rapidly); Examples of disturbances – including skin cleaning products; Examples of problems associated with disturbances.

<table>
<thead>
<tr>
<th>Issue 1</th>
<th>Points for</th>
<th>AND / OR</th>
<th>Points against</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.2.3.d Explain the relationship between the natural pH of the skin and
- the action of microflora
- natural oil produced by glands in the skin
- perspiration

**Explaining skin pH**

The natural pH of the skin is maintained by the action of glands in the skin. **The sebaceous gland produces sebum and this natural secretion is slightly acidic.**

**The effect of soap on the skin’s pH**

Washing your hands with soap increases skin pH. It changes from its usual acidic 5.5 to a higher pH of 9 to 10. Within 15 to 30 minutes the skin pH is back to normal. This is caused by the skin’s secretion of slightly acidic sebum.

If a person has a skin condition such as eczema, dermatitis or infection the return of skin pH to 5.5 could take longer, up to 24 hours. During this time, harmful bacteria or fungi could invade the skin. This could make the skin condition worse.

Adapted from a publication of EGO Pharmaceuticals

There are two types of sweat glands. Most are eccrine sweat glands that secrete a weak salt solution onto the skin. This helps maintain constant body temperature. **This perspiration, from the eccrine glands, is generally slightly acidic and helps maintain the acid mantle.** The apocrine sweat glands (located under the arms and around the pubic region) secrete a protein-rich fluid, sebum. Bacteria decompose this secretion to produce body odour.

The skin is the most effective barrier against the entry of microorganisms mainly because of its tough outer layer of closely packed dead cells, called the stratum corneum. These cells are filled with the fibrous protein keratin and stick together in flakes, which are continually shed from the surface. The stratum corneum is kept waterproof and supple by sebum released by the sebaceous glands. This is an oily mixture containing unsaturated fatty acids that favour the growth of certain kinds of beneficial bacteria. **The bacteria release acids as by-products of their metabolism** and help give skin a characteristic acid pH of between 4.5 – 6.0.

**Notes Questions**

14. Explain how do microflora cause the skin to be slightly acidic?
15. Explain how does the secretion of sebum cause the skin to be slightly acidic?
16. Explain how does perspiration help the skin maintain a low pH?
9.2.3.e Identify and explain the use of common components of body soaps, cleansers and shampoos and the reason for their use

**Components of Cleansing agents**

1. Match the following common components with the reason for their use.
2. Then write a sentence explaining the reason for the use of these common components.

<table>
<thead>
<tr>
<th>Common Components of Skin soaps, cleansers and shampoos</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common component</strong></td>
</tr>
<tr>
<td>Surfactants</td>
</tr>
<tr>
<td>Fragrances</td>
</tr>
<tr>
<td>Preservatives</td>
</tr>
<tr>
<td>Moisturizers</td>
</tr>
<tr>
<td>Moisturizers</td>
</tr>
</tbody>
</table>

**Notes Questions**

17. Name a substance that could be used in moisturizers.

18. Revision What is a surfactant?
Testing the Claims of Manufacturers - Introductory question

Read the label for POND’S Foaming Facial Cleanser & Toner. [13 marks]

POND’S
Foaming Facial
Cleanser & toner

Pond’s understands that you don’t always have time for a complicated skin care routine, so Pond’s Foaming Facial Cleanser & Toner combines two benefits in one.

First, the soap-free lather thoroughly cleanses away make-up, dirt and impurities without drying your skin.

Second, the gentle, pH balanced formulation tones and conditions, leaving your skin feeling clean and fresh.

To use ……………………..

Caution: Avoid contact with eyes.
In case of eye contact, rinse thoroughly with water

a. Identify the facts or claims made by POND’S about its product. [2 marks]
b. Identify the facts or claims that can be tested scientifically. [2 marks]
c. Outline how one of these claims could be tested scientifically. [3 marks]
d. Identify the safety issue related to using this POND’S product. [1 mark]

e. Evaluate the validity of the information supplied on the POND’S label [5 marks]

This question is an unstructured extended answer. Develop a rubric and then answer the question
Activity 3-3  Testing the Claims of Manufacturers

In order to sell products, manufacturers first need to describe their products. The description will state a number of facts and probably make some claims about the product. Some of these facts will be:
- absolutely true – eg contents
- able to be tested scientifically – eg pH neutral
- advertising jargon that is difficult or cannot be accurately measured scientifically – eg leaves your skin clean and fresh

In this activity you need to plan an investigation to test claims made by a manufacturers about their products. Completing the introductory question should be useful to organise some ideas about such an investigation. It is suggested that the claim you choose to investigate should be able to be tested scientifically.

<table>
<thead>
<tr>
<th>Planning</th>
<th>Information</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>In order to plan an investigation you need to first consider what claims you might test.</td>
<td>1. Write a heading for the investigation.</td>
<td></td>
</tr>
<tr>
<td>An easy claim to test is that a product has a certain pH range. A more difficult claim to test is that a product leaves your skin feeling clean and fresh.</td>
<td>2. Write an aim for the investigation.</td>
<td></td>
</tr>
<tr>
<td>Collect a variety of advertisements, labels or containers for products such as skin soaps, cleansers and shampoos. Write down the claims made by the manufacturer.</td>
<td>3. Write a method for the investigation.</td>
<td></td>
</tr>
<tr>
<td>Once you have decided which claim to test use VGMANS to plan your method.</td>
<td>a. Discuss tests that could be used.</td>
<td></td>
</tr>
<tr>
<td>• Identify independent variable – products</td>
<td>b. Select a test.</td>
<td></td>
</tr>
<tr>
<td>• Identify dependant variable – the claim(s)</td>
<td>c. List the instructions to be followed for each test, in point form.</td>
<td></td>
</tr>
<tr>
<td>• Control all other variables – keep tests, temperature, time etc the same.</td>
<td>d. Draw labelled diagrams if necessary.</td>
<td></td>
</tr>
<tr>
<td>• Groups – control &amp; experimental</td>
<td>4. Make a list of equipment needed.</td>
<td></td>
</tr>
<tr>
<td>• Can you measure the claim</td>
<td>5. List possible risks</td>
<td></td>
</tr>
<tr>
<td>• What activity will you use to test the claim</td>
<td>6. Record data in such a way that makes it easy to form a conclusion.</td>
<td></td>
</tr>
<tr>
<td>• Repeat test a number of times</td>
<td>7. Write a conclusion</td>
<td></td>
</tr>
<tr>
<td>• Are there any safety issues</td>
<td>8. Complete discussion</td>
<td></td>
</tr>
</tbody>
</table>
Marking criteria  [10 marks]

Syllabus Outcome - H11: 11.2 b, c, e  
Justifying an appropriate investigation plan. [5]

1. Identify variables that need to be kept constant.
2. Design investigations that allow valid and reliable data to be collected.
3. Predict possible issues that may arise during the course of the investigation.

Syllabus Outcome - H12: 12.2 b
1. Observe and describe results. [2]
2. Record results (table) [2]
3. Carry out repeat trials.

Syllabus Outcome - H13: 13.1 a  Present information
4. Use laboratory scaffold [1]

Discussion  [15 marks]

Syllabus Outcome - H12: 2.1 a, b, c, d  After performing the first hand investigation the discussion will focus on possible improvements. It might be possible to improve the accuracy and reliability of the investigation.

1. Outline how you minimised hazards and wastage of resources in this investigation. [2]

2. Describe the waste materials produced. [3]

3. Outline how you safely disposed of these waste materials. [2]

4. Identify some safe working practices used in this investigation. [2]

5. After you have carried out the planned investigation identify any changes you could make to your method. [3]
   • Did you choose the best tests?
   • Did you choose enough tests to produce reliable results?

6. Analyse the effect of these changes on your results (refer to validity or reliability). [3]
   • Validity means right method
   • In this investigation it means that the tests used clearly distinguished between O/w and W/O emulsions.
   • An investigation needs to be reliable to be valid.