

**CHEMICALS FOR CONSUMERS DETAILED NOTES
AND SAMPLE QUESTIONS**

(I regret for any mistake if noted)

**S4 TERM TWO TOPIC 2
NEW LOWER SECONDARY CURRICULUM
(CHEMISTRY)**

BY



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DEDICATED TO YOU

The attached questions are almost enough for a student to have a general idea/concept about this region(**content/subtopic**) in chemistry, however, I advise a student to search for more related questions about this content area for **better results**.

CONTENT:

1. **Chemicals for consumers.**
2. **Some sample questions on the above topic**
3. ***Try so hard to answer the sample questions and look for more qns.***

Don't say tomorrow, it will be too late for chemistry revision, and yesterday is gone forever, you have got today to revise your chemistry!

**"Revise as if tomorrow is not there" May
god bless you**

Chemicals for consumers

Introduction

The products we use in our daily life at home, school and in any place human beings visit or stay are made up of chemicals.

Examples of most commonly used products that are mostly used in daily life.

- Soapy and soap less detergents (soaps and detergents)
- Food additives
- Medicines
- Paints and many others.

Soaps and detergents

Soap is a potassium or sodium salts of a carboxylic acid attached to a long aliphatic chain.

Alternatively;

Soapy detergents are cleansing agents made by the reaction between fats or oils from animals or plants and sodium or potassium hydroxide.

Soaps are sodium or potassium salts of fatty acids, formed by the reaction fats and oils with an alkali.

Physical properties of soap.

- Soap is normally cream but takes up the colour of the palm oil. Mere palm oil produces creamy soap while palm kernel oil produces white solid soap.
- Soap takes up the odour of the kind of perfume used.
- Soap has a smooth texture.
- Easily soluble while washing.

Chemical properties of soap

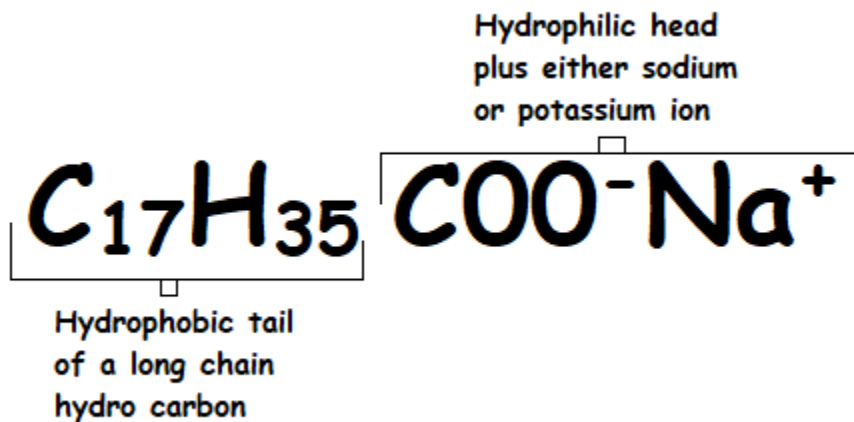
- Soap has a pH within the range of 9-10. Soap is majorly alkaline.
- Soap forms lather readily with soft water.

Chemical name of soap

- Sodium stearate ($C_{17}H_{35}COONa$) or potassium stearate ($C_{17}H_{35}COOK$).
Normally, $C_{17}H_{35}$ (alkyl group) is represented by R. i.e. R-COONa or R-COOK

Chemical formula of soap.

The exact chemical formula is $C_{17}H_{35}COO^-$ plus either sodium or potassium ion



The history of making soap

Earlier on, soap making was carried out by reacting fats and oils from animals and plants with ashes as a source of alkaline solution.

The mixture could be boiled to obtain the soap solution that could be molded into a shape according to one's desire.

Sample questions

1. What were the first materials used for making soap?
 - Animal fat and ashes
2. What challenges in production of soap were faced during early times?
 - Soap was heavily taxed
3. What improvements have been made in the production of soap?
 - Improved alkaline substances like caustic soda
 - Fats are now clean and free from animal body fat
 - Soap can now be made without boiling the mixture of fats/oils and caustic soda, but instead, just stirring and pouring in the mold.

Chemical nature of soap.

Soaps are water-soluble sodium or potassium salts of fatty acids.

The nature of soap depends on the chemicals used, the method and the intended use of the soap.

Chemicals used to make soap.

- Sodium hydroxide solution
- Fat/oil (long chain triglyceride)

Structure of a soap molecule.

A soap molecule is made up of two parts, a long hydrocarbon part and a short ionic part containing the -COO-Na^+ group.

The long hydrocarbon chain is hydrophobic in nature but it is soluble in grease and oil.

The ionic portion of the soap molecule is hydrophilic.

Importance of fats and oils in soap-making

- They help in the hardening of soap.
- Production of lather.
- Responsible for moistening.
- Enhancing the cleaning action of soap.

Cleaning action of soap

During washing, the soap molecules dissolve in water.

The soap molecules orient themselves in dirt/grease and water, the hydrophobic tails dissolve in oil/grease/dirt while the hydrophilic heads face in water.

Agitation begins to separate to grease from the object being cleaned.

Continuous agitation takes place until all the dirt leaves the surface of the object.

The cleaning will be completed when the broken dirt particles move in water after rinsing.

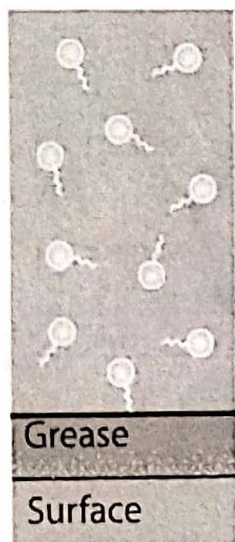
Diagrammatic/flow chart cleansing/cleaning action of soap

Key words:

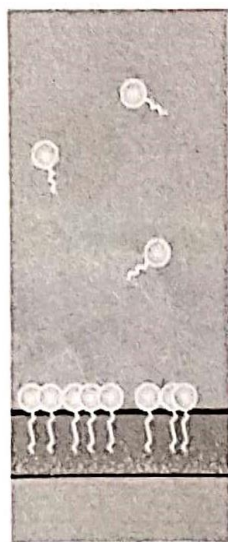
- Surfactant, is a substance that when added to a liquid reduces its surface tension thereby increasing its spreading and wetting.
- Agitation means disturbing or removing something by force.

The processes (a) up to (e) are the cleaning actions of soap and also detergents.

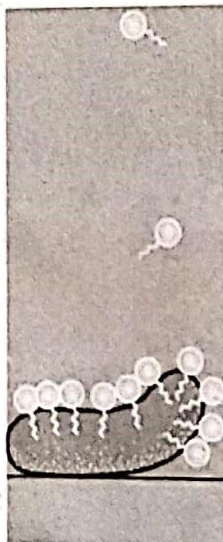
(a)
Soap or
detergent
dissolves
in water



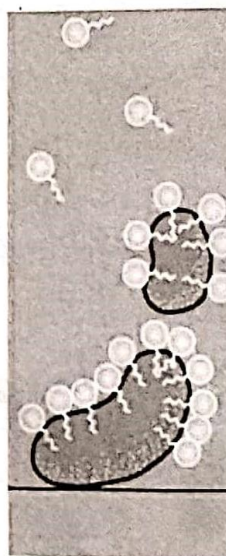
(b)
Surfactant
ions orientate
themselves in
grease and water



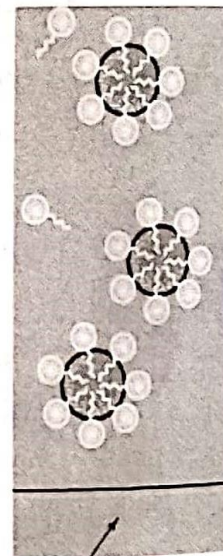
(c)
Agitation
begins to
separate
grease from
surface



(d)
Process
continues



(e)
Cleaning
complete



Clean surface

How a piece of cloth appears on rinsing

- The cloth appears clean and free from the previous dirt stains.

Effect of soap on the dirty piece of cloth

- The soap dissolves the dirt off the cloth into the water, leaving the cloth clean.

Detergents.

A detergent is the potassium or sodium salt of a long alkyl chain ending with a sulfonate group.

A detergent is a water-soluble cleansing agent which combines with impurities and dirt to make them more soluble.

Detergents differ from soap in not forming a scum with salts in hard water.

Detergents are also in powder form.

Chemical name and formula of detergents.

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Detergents are chemically known as *sodium alkyl sulphonate (or sodium dodecyl sulphate)/sodium alkyl benzene sulphonate/sodium dodecylbenzene sulphonate*.

The chemical formula is $C_{12}H_{25}NaO_3S$. The alkyl ($C_{12}H_{25}$) can be represented by capital R, hence $RNaO_3S$.

Examples of detergents.

- Nomi
- Omo
- Sunlight
- Liquid soap
- Sanitizers
- Jik
- Bleaches

Chemical composition of detergents.

- Alkyl sulphonic acid
- Sodium hydroxide
- Perfume and water

Additives (and their uses) present in detergents.

Additives	Uses
Fluorescent whitening agents	Convert stain to colourless substances
Fragrances (these are pleasant sweet smells)	Add fragrances to fabrics and detergents
Bleach (a chemical used to make materials whiter or lighter) e.g., sodium hypochlorite or sometimes hydrogen peroxide.	Make fabrics appear whiter
Enzymes	Breakdown fat and protein molecules in food stains.
Fabric softening agents (e.g., calcium hydroxide, sodium carbonate/soda ash)	To soften hard water
Drying agents	To make the solid detergent dry and enable the liquid detergent to be poured out easily.
colourants	Change and improve on the final color of the detergent.

Cleaning action of detergents.

The cleaning/cleansing action of detergents is exactly the same as for soap since they both have the hydrophilic and hydrophobic parts.

Preparation of detergents.

- Alkenes (any, especially from petroleum) are mixed with sulphuric acid to form alkane sulphonic acid.
- Sodium hydroxide is added to the sulphonic acid to neutralize it and form the detergent.
- Additives are then added to the formed detergent to enhance on the cleaning efficiency, add fragrance and control foaming.

Alternatively;

You can make your own powder detergent at home or in any place you stay using the following materials, get them from sunrise hotel opposite mukwano mall - Namayiba park Kampala.

Materials

- Soda ash 1 kg
- STPP 60g
- SLS 300g (pound it to powder form)
- Caustic soda 40g
- Fragrances.

Procedures

- Place caustic soda in a container/bucket, add STPP and mix until a uniform mixture is formed,
- Add SLS to the mixture and continue mixing until a uniform mixture is formed.
- Add caustic soda and continue mixing to form your detergent.
- Fragrances are added to the formed detergent and kept for 24 hours.
Then get your product and either use or sell.

Advantages of detergents over soaps.

- Detergents cannot form scum with hard water while soaps form scum with hard water.
- Detergents can work even in acidic medium while soaps cannot.
- Detergents are stronger cleansing agents than soaps.

- Detergents have a higher solubility than soaps.

Similarities between soaps and detergents.

- Their structures consist of a hydrophobic tail and a hydrophilic head.
- Soaps detergents are both surfactants as their structures allow them to reduce tension between oil and water.
- They both clean effectively in soft water.
- They both act as emulsifying agents.

Differences between soaps and detergents.

Soap	Detergent
Biodegradable	Non-biodegradable
Does not cause pollution	Causes pollution
Not effective in hard water	Effective in hard water
Not effective in acidic water	Effective in acidic water
Form scum in hard water	Does not form scum in hard water.
Made from natural resources (animal fats or vegetable oils)	Made from synthetic resources (petroleum fractions)
Form precipitate in acidic water	Do not form precipitate in acidic water

Food additives.

A food additive is any substance added to food to maintain or improve its safety, freshness, taste, texture and appearance.

Types of food additives.

Food additives are classified according to their source or the function.

Types according to source;

- Natural food additives
- Synthetic food additives

Types according to function;

Type of additive	Its example (chemicals present)	Use of the additive
Preservatives	Sodium benzoate, Ethylene oxide	Increase the shelf life of food by preventing the growth of micro-organisms like yeast or bacteria in food.

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Antioxidants	Naturally available ascorbic acid, Butylated Hydroxy Anisole (BHA), Sulphur dioxide, Butylated Hydroxy Toulene (BHT)	Added to food products to prevent rancidity.
Sequestrants	Iron or copper	Act as metal scavengers and prevent oxidation, there by thereby improving the quality and stability of food.
Surface active agents	Lecithin found in egg Yolk. Mono diglycerides.	Are necessary to stabilize an emulsion, whether its oil in water or gas in liquid type.
Stabilizers and thickening agents	Pectin. Amylose Gelatin.	Increase viscosity by combining with water to form gels, hence are used for thickening.
Bleaching and maturing agents	Benzoyl peroxide, Hydrogen peroxide.	Used to bleach yellow colour. Used to alter properties of Maida (all-purpose flour especially for making breads) into aata (more pure form of maida) due to reaction with benzoyl peroxide.
Food colour	Turmeric, Annatto, Caramel, Saffron, Carotene, Cochineal, Certified coal tar dye.	Added to improve on the visual looks.
Dietary sweeteners	Aspartame	Improve on aroma and taste.
Flavouring agents	Ethyl butyrate for pineapple flavour, Amyl acetate for banana flavour, Methyl anthranilate for grape flavour. Benz aldehyde for cherry flavour. Etc.	Improve on the food odor, Improve on the food quality.
Anti-caking agents	Calcium phosphate, Magnesium carbonate.	Used to keep the product from clumping together.

Banned food additives.

Some food additives can trigger allergic reactions and other mid health problems. However, some food additives pose serious health risks and have been banned for consumption.

Examples of banned food additives and the reasons.

Food additive	Reasons for banning
Bisphenol A	Changes the timing of puberty, Decreases fertility and increases body fat.
Phthalates	Affects male genital development and increases childhood obesity.
Nitrates/nitrites	Cause tumours (a swelling of a part of the body without inflammation, caused by abnormal growth of tissue) in the digestion and nervous system.
Synthetic/artificial food colours.	They have effects on child behaviour and attention.

Medicines

Medicines are classified into two;

➤ **Traditional medicine**

- These the medicines derived from plants or animals.
- They are usually not processed.
- They cause a lot of side effects.

Types of traditional medicine

Traditional medicine	Source	Function
Garlic extract	Garlic leaves	Controlling the level of cholesterol and blood pressure.
Guava leaf and flower extract.	Guava plant	Treats malaria, ulcers, coughs, diarrhoea
Aloe vera extract	Aloe vera plant	Treatment of malaria
Lemon juice	Lemon plant	Treats hypertension, obesity, bronchitis and fever.
Pawpaw leaf and root extract.	Pawpaw	A natural contraceptive, improves liver and kidney function.
Bitter leaf	Some plants	Used for fever and malaria treatment
Bombo (Momordica foetida)		Used for fever and malaria treatment

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Sodom apple	Sodom plant	Treatment of; leprosy, toothaches, wounds, scabies, etc.
Cactus juice (take it before or after an exercise)	Cactus plant	It promotes immune system, Soothes joint inflammation, Reduces pain and prevents inflammation.
Avocado leaves	Avocado plant	Treats a variety of diseases, including cancer, diabetes and more.

How to obtain traditional medicines

Generally, most herbal/traditional medicines are squeezed or crushed and mixed with some water. The resulting solution is decanted and drunk as the medicine.

Side effects of herbal/traditional medicine

Being natural, does not necessarily mean that the medicines are safe for human consumption.

They have some side effects which include;

- They cause stomach upsets
- Cause sleeplessness.
- Cause pains in human muscles and joints

How to improve on the herbal medicine

- Herbal medicines should be prescribed by qualified and registered practitioner.
- The methods of extraction should be improved in order to extract a reasonable quantity of the active ingredients.
- Methods of packaging and conservation should also be improved.

How to minimize the side effects

- Taking prescribed herbal medicines
- Consult your health practitioner immediately if you experience any side effect.
- Reduce on the dosage.
- Do more exercises but not in the late evening.
- Make a daily schedule of your medicine
- Talk to your herbal practitioner about what to do when you miss a dose.

Type 2

- **Modern or Conventional medicine**

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These are medicines made by scientists in laboratories and are based on substances found in nature.

The active ingredients in the substances are identified, extracted and purified.

The medicine is then tested repeatedly in many different ways before it is marketed. This allows scientists to make sure that the medicine is safe and to identify its side effects.

Modern medicines may come in many forms such as liquids, powders, capsules and tablets, capsules and tablets.

Types of modern medicine.

Modern medicine		Function
Analgesics	Aspirin	Analgesic (against minor pains and aches) Prevent heart attacks, Works on fever.
	Paracetamol	Painkiller used to treat aches and pain.
	Codeine	Relieve mild to moderate.
Antibiotics	Penicillin	Cure diseases that are caused by bacteria infection such as gonorrhoea, syphilis, anthrax, pneumonia, meningitis.
	Streptomycin	Antibiotic remedy for dry cough, tuberculosis.
	Cofita tablets	Used for treatment of flu and cough.
Psychotherapeutic	Stimulants	Therapeutically drugs to increase alertness.
	Antidepressants	Affects moods and emotions helping you to feel better.
	Antipsychotics	Regulate the function of the brain that controls thinking, mood and perception
Antidepressants	Hormones	They evoke responses from specific organs or tissues.
	Insulin	Regulates the level of sugar in the blood
	Steroids	Responsible for; Sexual differentiation, Growth, Development, Reproduction.
	Anabolic steroids	They promote cell growth and division.

Side effects of modern medicines and how to reduce the effects

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Side effect	How to manage the effect
constipation	Drink plenty of fluids.
Daytime drowsiness	Ask your doctor if you can take your medicine at bedtime. It goes away when the body adjusts to the medicine.
Diarrhea	Eat fibre foods, Avoid spicy and high-fat foods until you feel better.
Dizziness	Get up slowly from sitting or lying down.
Dry mouth	Take frequent sips of water throughout the day.
Headaches	Ask your doctor which medicine you can take for a headache. Headache normally goes away as the body adjusts to the medicine.
Loss of appetite	Include your favorite foods at each meal, Try to eat more often, Take a walk before you eat, this may make you hungrier.
Sleep problems	Don't exercise in the late afternoon or evening, Keep your bedroom quiet, dark and cool, Change the time of day you take your medicine to the morning, Avoid caffeine, nicotine and alcohol.

Contribution of the chemical industry to people's lives.

The chemical industry has contributed to people's lives through the following sectors

Sector	Chemical product	Importance to people's lives
Transportation	Fuel	Source of fuel which provides energy for moving.
Decoration	Dyes	Chemical dyes have pigments of different colors for coloring objects.
Hygiene	Sanitizers, and other detergents like methylated spirit, etc	Sanitizers improve on people's health by killing disease causing organism on the body.

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Food	Food additives	Additives in making food stuffs to improve appearance, taste and quality.
Water treatment	Chlorine	Provides safe water for domestic use when added to water, for example small amounts of chlorine.
Agriculture	Fertilizers, pesticides	Manufacture of fertilizers and pesticides which improve crop yield.

Traits of a good science researcher.

- Analytical mind
- Ability to stay calm
- Intelligence
- Curiosity
- Quick thinking
- Systematicness (getting involved personally)

Qualities of scientists carrying out research.

Good and successful science researchers should have the following characteristics

- **Patience**
Enables researchers not to diminish their persistence and passion.
- **Meticulousness**
Enables researchers to do things very carefully and pay great attention to detail.
- **Perseverance**
Enables researchers to keep doing work and studying regularly and to never give up even under difficult situations.
- **Innovativeness**
Enables researchers to come up with new ideas to get the work done.



Sample Activity of Integration

In Rwera community, there is a variety of people producing various products. Some of the local farmers produce agricultural products like milk, ghee, honey, fruits, fruit juice and groundnut paste. Others make traditional medicine extracts from herbs and other plants.

However, they have a challenge as their products get spoilt very fast and also their clients complain that their products are not good enough like other products on the market.



Task:

As a learner of chemistry, you have been invited by the District Health Officer to address the community of Rwera on how to improve the quality of their products, make them last longer and maximumly utilise the locally available chemicals. Write a special message that you would deliver.

Sample Assessment Grid

Output	Basis of evaluation	Criterion 1: Relevance	Criterion 2: Accuracy	Criterion 3: Coherency	Criterion 4: Excellence
Message	How to improve - the quality of chemical products, make them last longer, and how to maximumly utilise locally available chemicals	<p>Score 3: If a learner's message includes information on how to improve the quality of chemical products, make them last longer and how to maximumly utilise locally available chemicals</p> <p>Score 2: If a learner's message includes information on only two of the three aspects</p>	<p>Score 3: If the information given on the three aspects is correct</p> <p>Score 2: If the information given on the two aspects is correct</p>	<p>Score 3: If the learner explains well and there is logical flow in the information given on the three aspects</p> <p>Score 2: If the learner explains well and there is logical flow in the information given on the two aspects</p>	<p>Score 1: If a learners message is detailed and clear, and includes specific extensive, information on how locally available chemicals can be maximumly utilised.</p>

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		Score 1: If a learner's message includes information on only one of the three aspects	Score 1: If the information given on the one aspects is correct	Score 1: If the learner explains well and there is logical flow in the information given on the one aspect
Total /10		/3	/3	/3

Sample Activity of Integration

Cough and flue infections are on the rise in your community. Community members move long distances to get medical attention. Herbalists have tried to address the problem but community members think herbal medicine is a waste of money. A meeting is organised to address the health situation. As a student of Chemistry, prepare a speech to the community to handle the health challenge.



Assessment Grid

Output	Basis of evaluation	Relevance	Accuracy	Coherence	Excellence
Written speech to the community on herbal and industrial medicine	Presence of chemicals in daily substances used; <ul style="list-style-type: none"> ⊙ Common substances/ products containing chemicals. ⊙ Transforming common substance to useful products locally (herbs, alcohol, juice among others) ⊙ Transforming common substance to useful product industrially (Medicines, alcohol, beverages, hair chemicals among others) ⊙ Examples of useful transformed products 	Scores 3 if the learner provides any 3 to 4 descriptions about chemicals and substances.	Scores 3 if the learner accurately provides any 3 to 4 descriptions about chemicals and substances.	Scores 3 if the learner logically provides any 3 to 4 descriptions about chemicals and substances.	Scores 1 if an unsolicited for or unique but related idea has been presented.
		Scores 2 if the learner provides any 2 descriptions about chemicals and substances.	Scores 2 if the learner accurately provides any 2 descriptions about chemicals and substances.	Scores 2 if the learner logically provides any 2 descriptions about chemicals and substances.	
		Scores 1 if the learner provides any 1 descriptions about chemicals and substances.	Scores 1 if the learner accurately provides any 1 descriptions about chemicals and substances.	Scores 1 if the learner logically provides any 1 descriptions about chemicals and substances.	
Total		03	03	03	01

Activity of integration

The materials we use for our everyday livelihood including water are chemicals. Water and sanitation are essential for life and health, but they are also essential for dignity, empowerment and prosperity. Water and the use of some of these chemicals/materials that support sanitation/basic source of food are human rights, fundamental to every child and adult. However because of Covid-19 pandemic and lock down the prices of the cleaning agents have become high and they are also scarce.

Some of these chemicals/material including soap, utensils, fertilisers, food and others can be locally made from home.



TASK

Prepare a short write up to sensitise your community how you they can support their own sanitation by using locally prepared cleaning agents.

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Assessment Grid

Output	Basis of evaluation	Relevance	Accuracy	coherence	Excellence
Written recipe for preparation of soap	<ul style="list-style-type: none"> Requirements and process of soap preparation 	Score 3 if: the recipe mentions at least 7 of the following; saponification, glass beaker, glass rod, measuring cylinder, funnel, filter paper, source of heat, tripod stand, 20% sodium hydroxide, oil/fat, saturated solution of sodium chloride	Score 3 if: the recipe correctly mentions at least 7 of the following; definition of saponification, capacity of., 20% sodium hydroxide solution, 25mls of oil, 20ml of 20% sodium hydroxide, constant stirring, heating the mixture until it turns clouding, adding 10 mls of saturated sodium chloride solution, cooling the hot solution, filtering the cooled solution to obtain solid soap.	Score 3 if: the recipe logically mentions at least 7 of the following; definition of saponification, , measure 25mls of oil and transfer into 250ml beaker, add 20ml of 20% sodium hydroxide, constantly stir the mixture, heat the mixture while stirring until it turns clouding, add 10 mls of saturated sodium chloride solution, cool the hot solution, filter the cooled solution to obtain solid soap.	Score 1 if: recipe has information how to quality of soap can be improved
		Score 2 if: the recipe has 4 to 6 of the above	Score 2 if: the recipe correctly has 4 to 6 of the above	Score 2 if: the recipe logically has 4 to 6 of the above	
		Scores 1 if: the recipe has at less than 4 of the above	Scores 1 if: the recipe correctly has only less than 4 of the above	Scores 1 if: the recipe logically has only less than 4 of the above	
		x/3	x/3	x/3	
TOTAL	x/10				x/1