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90730

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Science, 2004

90730 Describe selected chemical substances and their uses

Credits: Four
2.00 pm Wednesday 17 November 2004

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

If you need more space for any answer, use the page provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–10 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement Criteria *For Assessor's use only*		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe selected chemical substances and their uses. ☐	Explain selected chemical substances and their uses. ☐	Discuss selected chemical substances and their uses. ☐
Overall Level of Performance ☐		

You are advised to spend 45 minutes answering the questions in this booklet.

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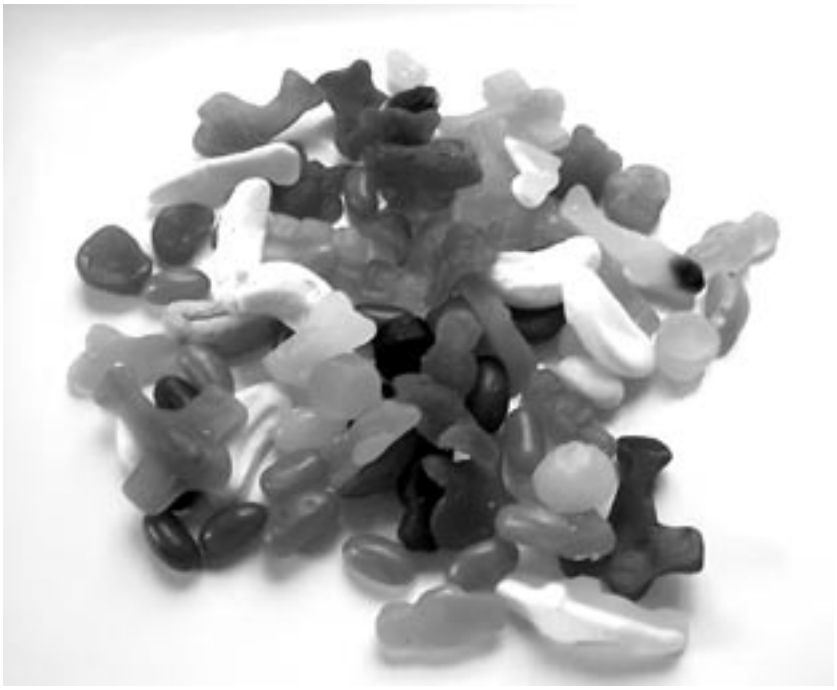
QUESTION ONE: ACIDS, ALCOHOLS AND ESTERS



Esters can be used as flavouring agents for sweets.
One of the commonly used esters has a formula of $CH_3\,\underset{\underset{O}{\|}}{C} - O - CH_2\,CH_2\,CH_2\,CH_3$.

(a) (i) Name this ester.

_____

(ii) **Circle** the functional group of the ester above.

(b) The ester with the formula above is made from an alcohol and carboxylic acid.

(i) Name and draw the formula of the alcohol.

Name of alcohol

_____

Formula

(ii) Name and draw the formula of the carboxylic acid.

Name of carboxylic acid

_____

Formula

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(c) A group of students were making this ester in the science laboratory. They placed 5 drops of the carboxylic acid into a boiling tube and added 10 drops of the alcohol. Another substance, **X**, was added to the boiling tube, and the tube was placed into a water bath and heated for 2 minutes.

carboxylic acid + alcohol $\overset{\mathbf{X}}{\rightleftharpoons}$ ester + water

(i) Name the substance **X** added to the boiling tube.

_____

The students found from a textbook that the reaction was in equilibrium.

(ii) Discuss how substance **X** alters the equilibrium reaction to produce the ester.

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(d) At the end of the process of forming the ester in (c), sodium carbonate is added.

Explain why sodium carbonate is added at this stage.

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QUESTION TWO: FATS AND OILS

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(a) A **triglyceride** is made up of fatty acids and one other main component. Name the other component.

_____

(b) Fatty acids can be either saturated or unsaturated. This difference has a major effect on the physical properties of the fatty acid.

(i) Describe what the term **unsaturated** means in relation to fatty acids.

_____

_____

_____

(ii) Describe how ONE physical property is affected by whether the fatty acid is saturated or unsaturated.

_____

_____

_____

(c) The degree of unsaturation of a fat or oil is often indicated by the **iodine number**. The iodine number represents the number of grams of iodine that will react with 100 grams of the fat or oil.

Table One shows a list of fats and oils, along with their average iodine number.

Table One

FAT OR OIL	AVERAGE IODINE NUMBER
Butter fat	28
Beef fat	38
Cocoa butter	38
Olive oil	84
Cottonseed oil	107
Corn oil	120
Linseed oil	177

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(i) Explain the significance the iodine number has to the degree of unsaturation of the fat or oil. Refer to the information in Table One.

(ii) Sardines are fish that live in very cold water. The iodine number for sardine oil is 185. Discuss why the iodine number is higher for the sardine than other animals.

QUESTION THREE: SOAPS AND DETERGENTS

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(a) Grease-covered hands can be cleaned with soap, as water on its own does not act as an effective cleaning agent.

(i) Draw and label a diagram of a soap molecule.

(ii) Discuss how soap removes grease from hands. Draw a diagram to help your answer.

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(b) More soap is needed to remove grease if hands are washed in hard water. Certain metal ions make the water hard.

(i) Name or give the formulae of the TWO main ions that cause water to be hard.

(ii) Explain why more soap is needed in hard water than in soft water.

(c) Detergents can be used in hard water.

The following formula represents the detergent molecule **sodium lauryl sulfate** found in many dishwashing liquids.

$$\mathbf{CH_3(CH_2)_{11}OSO_3^-\ \ Na^+}$$

(i) **Circle** the **ion** that acts as the detergent.

(ii) Sodium lauryl sulfate is an example of an **anionic** detergent.

Describe an **anionic** detergent.

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number