

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019
Topic: Electrolysis

Stage 1 - Desired Results

Established Goals:

In this chapter, we will investigate the electrolysis process and how the process is applied to aqueous solutions by studying the electrolysis of water; dilute sulphuric acid and aluminium oxide dissolved in molten Cryolite. In addition, we will explore the concept of electroplating and study the possible materials used for the production of electrodes and the reasons behind the choice of these materials.

Understandings:

Students will understand ...

- ✓ The parts of the equipment used for the electrolysis process.
- ✓ The steps in the electrolysis process.
- ✓ Determine the composition of water
- ✓ The uses of the products made from the electrolysis.
- ✓ How electrolysis applies on different substances and what are the products formed
- ✓ The process of electroplating.

Essential Questions:

- ✓ What are the names of the different electrodes and what are their roles?
- ✓ How do the components of a compound and their positions on the reactivity series allow us to predict how the electrolysis will occur?
- ✓ How does electrolysis allow us to separate a compound into its components?
- ✓ What are the uses of the products of the electrolysis process?
- ✓ Why the aluminium oxide is dissolved in molten cryolite?
- ✓ What is the process of electroplating?
- ✓ What are the uses of electroplating?

Knowledge:

Students will know ...

- How to set up equipment needed for the electrolysis process.
- How to be knowledgeable about scientific concepts and theories.
- How to be able to use the properties of the products of electrolysis and be able to use this scientific knowledge to apply to real-world problems.
- How to Think analytically by evaluating evidence using relevant criteria; develop appropriate conclusions as well as new questions.
- How to communicate ideas clearly, both written and verbal.
- How to read and interpret scientific diagrams and use them to set up equipment in real life.

Skills:

Student will be able to:

- ✓ Demonstrate electrolysis as the condition of electricity by an ionic compound.
- ✓ Illustrate the process of electrolysis.
- ✓ Show electrolysis as an evidence of existence of ions.
- ✓ Utilize the reactivity series and other information about the process of electrolysis to predict the products produced at the cathode, anode and the other products when electrolyzing a compound.
- ✓ Explain why the aluminium oxide is dissolved in molten cryolite, the properties of cryolite and why cryolite helps with the electrolysis of the aluminium oxide.
- ✓ Relate the reactivity of elements to the position in the periodic table, for predicting the results of the electrolysis.
- ✓ Identify required properties of materials used to make electrodes.
- ✓ Construct ionic equations for the reaction.

Stage 2 - Assessment Evidence

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

Performance tasks:

- Homework: Labelling the steps of the electrolysis setup and process.
- Worksheet on electrolysis of different substances.
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- Electrolysis experiment
- Group Research assignments and presentation on application of electrolysis
- End of the unit questions

Other Evidence:

- ✓ Two individual assessments (Mid-Term/Final) accounting for the assigned percentage of the overall course grade.
- ✓ Homework, participation, behavior and attendance.
- ✓ Grades based on presentation of knowledge and ideas.

Stage 3 – Learning Plan

Learning Activities

- Lecture/Discussion/Overhead Presentation.
- White board.
- Small-group work/Cooperative Learning.
- Videos related to the subject.
- Interpreting an illustration/ lab skills.
- Choosing elements for real life purposes based on their properties.

What is the process of electrolysis and electroplating?

- Make a poster/ Labelling the steps of the electrolysis setup and process
- Quiz on uses of electrolysis

How do the components of a compound and their positions on the reactivity series allow us to predict how the electrolysis will occur?

- Worksheet on writing ionic equations for the reaction

What is the difference between the products of different substances being electrolyzed?

- Class discussion on the differences between the products.
Video Analysis

Discuss in groups -

- What are the roles of an anode and a cathode?
- Why do we use electrolysis?
- How can electrolysis be used in the real world?
- What are the necessary properties of materials used to make an electrode?
- What is electroplating?

The Asian International School
Unit Backward Design
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Topic: Acid Base and Salt

Stage 1 - Desired Results

Established Goals:

In this lesson students will learn about the properties of acids and bases in relationship to the pH scale. Focus on the reactions of acids and bases. The lesson highlights the difference between acids and alkali and also looks at the acid base properties in non-metal oxide and metal oxide. In addition, students will discuss reactions of acids with metals, with alkali and base called neutralization.

Understandings:

Students will understand ...

- ✓ The properties of acids and bases in relationship to the pH scale.
- ✓ Students will apply rules of nomenclature to acids, bases and salts.
- ✓ The characteristic properties of acids as in reactions with metals, base and carbonates.
- ✓ Compare the strengths of acids and bases. Understand Acid base neutralization reaction.
- ✓ Understand the importance of controlling the pH in soils and how excess acidity can be treated.
- ✓ classify oxides as acidic, basic, or amphoteric based on metallic or non-metallic character

Essential Questions:

- ✓ What is the difference between acids and bases using their properties?
- ✓ How do acid/base/salt reactions show the principles of chemistry?
- ✓ What are the components of acid base neutralization reactions?
- ✓ What are different types of indicators?
- ✓ What are the applications of acid/base reactions and their impact on our lives and the environment?
- ✓ How do we determine whether a solution is acidic or basic using an indicator?
- ✓ How do we Interpret pH in terms of powers of ten?

Knowledge:

Students will know ...

- ✓ Writing and balancing equations.
- ✓ Reading/using volumetric devices.
- ✓ Using a calculator for arithmetic operations.
- ✓ Proper handling of potentially hazardous materials.
- ✓ Articulate conclusions based on evidence.
- ✓ How to make observations from a scientific perspective.
- ✓ How to be able to think scientifically a use scientific knowledge to make decisions real world problems.
- ✓ How to Think analytically by evaluating evidence using relevant criteria; develop appropriate conclusions as well as new questions.
- ✓ How to communicate ideas clearly, both written and verbal.
- ✓ How to read, interpret & examine scientific claims.
- ✓ How to pose questions & form hypotheses based on personal observations, scientific articles, experiments & knowledge.

Skills:

Student will be able to:

- ✓ Identify substances as acids and bases.
- ✓ Write neutralization equations and predict resulting pH.
- ✓ Compare values on pH scale and choose appropriate indicators.
- ✓ Compare strengths of acids /bases.
- ✓ Identify set-up for titration and calculate unknown concentration when given data.
- ✓ Identify causes and solutions of acid rain.
- ✓ Complete an acid base titration and use the concept of molarity to determine the concentration of a titration reaction
- ✓ preparation on soluble and insoluble salts
- ✓ Discuss and demonstrate some observable properties of acids and bases using HCl and NaOH , litmus, magnesium

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

Stage 2 - Assessment Evidence	
<p>Performance tasks:</p> <ul style="list-style-type: none"> • Class work on Identification using properties of acid and base. • Research assignments on the uses of acids and base • Video Analysis • Experiment: Identifying acids and bases • End of the Unit questions • Group Presentations on characteristic reactions of acids with metals, alkali/base, metal carbonates • worksheet on acid reactions in daily life- indigestion, soil pH and plant growth etc • experiment on acid base titration- lab report 	<p>Other Evidence:</p> <ul style="list-style-type: none"> ✓ Two individual assessments (Mid-Term/Final) accounting for the assigned percentage of the overall course grade. ✓ Homework, participation, behavior and attendance. ✓ Grades based on presentation of knowledge and ideas.
Stage 3 – Learning Plan	
<p>Learning Activities</p> <ul style="list-style-type: none"> • Lecture/Discussion/Overhead Presentation. • Small-group work/Cooperative Learning. • Videos related to the subject. • Lecture on acid, base and its properties • Work sheet on neutralization reactions. • Interpreting an illustration/ lab skills • laboratory experiments • Research and presentation on News articles on acid rain • Discuss and demonstrate some observable properties of acids and bases using HCl and NaOH , litmus, magnesium. • Group Presentations on characteristic reactions of acids with metals, alkali/base, metal carbonates <p><u>What are the applications of acid/base reactions and their impact on our lives and the environment?</u></p> <ul style="list-style-type: none"> • Make a poster. • Discussion on acid/base reactions and their impact on our lives and the environment. <p><u>How do we determine whether a solution is acidic or basic using an indicator?</u></p> <ul style="list-style-type: none"> • Demo. • Lab work. <p>Discuss in groups -</p> <ol style="list-style-type: none"> 1. Acid Rain Debate 2. The excess stomach acid is neutralized with a base (Alka-Seltzer). A neutralization reaction always produces salt and water. 3. uses of salt 4. Express their opinions about the roles of acids and bases in the world. 5. Explain how their study has changed their opinions about acids and bases and other 	

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

substances.

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019
Topic: Oxidation-Reduction reactions

Stage 1 - Desired Results

Established Goals:

In this Unit we will be looking oxidation and reduction reactions (redox) in terms of oxygen/hydrogen gain /loss. Define oxidation and reduction. Assign oxidation numbers to atoms in simple compounds. Recognize a reaction as an oxidation-reduction reaction.

Understandings:

Students will understand ...

- ✓ To describe the key chemical event in oxidation-reduction reaction.
- ✓ Understand the concept of oxidation numbers.
- ✓ To describe "oxidation" and "reduction".
- ✓ To determine whether or not a chemical reaction is oxidation-reduction reaction.
- ✓ To identify species that are "oxidized" and/or "reduced" and to identify those species those are "oxidizing agents" and/or "reducing agents" in an oxidation-reduction reaction.
- ✓ Describe redox reactions in aqueous solution including writing balanced equations for oxidation and reduction reactions.

Essential Questions:

- ✓ What is a redox reaction?
- ✓ What types of reactions are also classified as redox reactions?
- ✓ What are the characteristics of oxidation-reduction (redox) reactions?
- ✓ what are the nine rules for assigning oxidation numbers?
- ✓ What do oxidation numbers represent, and how does one assign oxidation numbers to atoms and ions?
- ✓ How are oxidizing agents and reducing agents defined?
- ✓ What does a half-equation show?

Knowledge:

Students will know ...

- How to make observations from a scientific perspective
- How to be knowledgeable about scientific concepts and theories
- How to be able to think scientifically a use scientific knowledge to make decisions real world problems.
- How to Think analytically by evaluating evidence using relevant criteria ; develop appropriate conclusions as well as new questions
- How to Communicate ideas clearly, both written and verbal
- How to read, interpret & examine scientific claims
- How to pose questions & form hypotheses based on personal observations, scientific articles, experiments & knowledge

Skills:

Student will be able to:

- ✓ Differentiate acid-base and precipitation reactions from redox reactions.
- ✓ Define oxidation and reduction in terms of electron loss and gain.
- ✓ Deduce the oxidation number of an element in a compound.
- ✓ Deduce whether an element undergoes oxidation or reduction in reactions using oxidation numbers.
- ✓ Deduce simple oxidation and reduction half-equations given the species involved in a redox reaction.
- ✓ Deduce redox equations using half reactions.
- ✓ Define the terms oxidizing agent and reducing agent.
- ✓ Identify the oxidizing and reducing agents in redox equations.
- ✓ Classify reactions by type.

Stage 2 - Assessment Evidence

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

Performance tasks: <ul style="list-style-type: none">• worksheet-Identify species being oxidized and reduced• Homework: Creation of poster that explains oxidation and reduction• quiz Identification of whether a reaction is reduction or oxidation.	Other Evidence: <ul style="list-style-type: none">✓ Two individual assessments (Mid-Term/Final) accounting for the assigned percentage of the overall course grade.✓ Homework, participation, behavior and attendance.✓ Grades based on presentation of knowledge and ideas.
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Stage 3 – Learning Plan

Learning Activities

- Lecture/Discussion/Overhead Presentation.
- Small-group work/Cooperative Learning.
- Videos related to the subject.
- Explanation about reduction and oxidation
- Creating acronyms to help students remember how to differentiate between oxidation and reduction.
- Group research work on the application of reduction and oxidation
- Identifying whether a chemical reaction is oxidation or reduction.
- Watching videos that explain how increasing quantities cause changes in reduction and oxidation
- Write equation for rusting and other everyday examples of redox

What is oxidation and reduction and how are they different?

- Make a poster
- Quiz on oxidation and reduction

How to identify whether a reaction is oxidation or reduction?

- Class discussion on identifying between oxidation and reduction.
- Practice questions on identifying between oxidation and reduction.

Discuss in groups -

- What are the differences between oxidation and reduction?
- How is oxidation and reduction used in industry?
- What factors can affect the rate of oxidation and reduction?
- How to increase the rate of oxidation and reduction to its maximum?

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019
Topic: Metals

Stage 1 - Desired Results	
<p>Established Goals:</p> <p>In this unit, students will learn the properties of metals in relation to its position in the periodic table. In addition, students will study about the activity series for metals and its use in selecting metals for particular purpose.</p>	
<p>Understandings: <i>Students will understand ...</i></p> <ul style="list-style-type: none"> ✓ Metals and their properties. ✓ To construct balanced symbol equations for the reactions of metals with oxygen, water and acids. ✓ The properties of metals and how their uses relate to these properties, their chemical reactions and how we extract them from their ores. 	<p>Essential Questions:</p> <ul style="list-style-type: none"> ✓ How do metals react with water, oxygen and dilute acids. ✓ How ease of extraction and use through history relate to reactivity? ✓ Why quantitative calculations are necessary? ✓ How uses of metals relate to properties? ✓ Why should these properties of metal be taken into consideration when choosing a type of metal for construction?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> ✓ Be able to make observations from a scientific perspective. ✓ Be knowledgeable about scientific concepts and theories. ✓ Be able to think scientifically a use scientific knowledge to make decisions real world problems. ✓ Think analytically by evaluating evidence using relevant criteria ; develop appropriate conclusions as well as new questions ✓ Communicate clearly, both written and verbal. ✓ Be able to read, interpret & examine scientific claims. ✓ Be able to pose questions & form hypotheses based on personal observations, scientific articles, experiments & knowledge. 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> ✓ To know that metals are extracted from their ores by reacting them with some other substance. ✓ To know the relationship between properties and uses of metals. ✓ Utilize previous knowledge of chemical reactions and moles when applying stoichiometric calculations to a chemical reaction. ✓ Predict whether or not a displacement reaction will occur? Construct word (and simple symbol) equations for these reactions. ✓ Use an analogy to describe the concept of metal displacement
Stage 2 - Assessment Evidence	
<p>Performance tasks:</p> <ul style="list-style-type: none"> • class work -Construct balanced symbol equations for the reactions of metals with oxygen, water and acids. • Use the reactivity series to predict whether 	<p>Other Evidence:</p> <ul style="list-style-type: none"> ✓ Two individual assessments (Mid-Term/Final) accounting for the assigned percentage of the overall course grade. ✓ Homework, participation, behavior and attendance.

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

<p>or not a displacement reaction will occur, and name the products formed; construct word (and simple symbol) equations for these reactions.</p> <ul style="list-style-type: none">• Describe some real-world examples of displacement reactions• Worksheet Identification using properties of metals.• <u>Homework</u>: Creation of a poster including different metals and their uses.• Write a word (and symbol) equation for the formation of rust. Describe some methods used to prevent the corrosion of metals (physical barriers, sacrificial protection, galvanizing), and explain how they work.	<p>✓ Grades based on presentation of knowledge and ideas.</p>
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Stage 3 – Learning Plan

Learning Activities

- Lecture/Discussion/Overhead Presentation.
- Small-group work/Cooperative Learning.
- Videos related to the subject.
- Explanation about properties, uses and reactivity of metals.

What are the different properties of metals?

- Make a poster
- Quiz on uses of metal properties.

How can we choose which metals to use based on their properties?

- Class discussion
- Worksheets

Discuss in groups -

- What are the properties of metals?
- Which metals are electrical conductors?
- Which metals are heat conductors?
- Which metals should be used to make wires?
- Which metals should be used to make kitchen utensils?
- Explain, in terms of reactivity, why some metals corrode faster than others.

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019
Topic: Quantitative Aspects Of Formula and Equations

Stage 1 - Desired Results

Established Goals:

In this chapter, we will investigate the atomic mass and molecular mass of elements. We will learn to measure quantities of an element using moles, and write balanced equations and formula using moles, molecular mass and atomic mass to. In addition to balanced equations, we will also practice conversions between mass, moles and numbers of atoms or molecules and will be discussing mass calculations.

Understandings:

Students will understand ...

- ✓ The importance of quantitative calculations.
- ✓ What is the molecular mass
- ✓ What is the atomic mass
- ✓ How to use moles as a unit of measurement for quantities of elements.
- ✓ Conversion between mass, moles and number of atoms or molecules.
- ✓ How to use moles to write balanced chemical equations.
- ✓ To calculate the theoretical yield, actual yield, and percent yield for a chemical reaction

Essential Questions:

- ✓ Why quantitative calculations are necessary?
- ✓ What is relative atomic mass(atomic weight)
- ✓ What is relative molecular mass (molecular mass)?
- ✓ How to work out the formula mass/formula weight of an element?
- ✓ How to calculate the mass of one mole of an element?
- ✓ How to use moles as a unit of measurement for calculations and balancing equations?
- ✓ What is a yield and why is it important?
- ✓ How to calculate formulae from experimental data?
- ✓ How to calculate the mass of an element from chemical equations?

Knowledge:

Students will know ...

- How to be knowledgeable about using moles as a unit of measurement
- How to calculate the mass of one mole of an element using the periodic table.
- How to use the relative atomic mass and molecular mass in balancing chemical equations.
- To convert between mass, moles and numbers of atoms or molecules.
- How to Think analytically by evaluating evidence using relevant criteria ; develop appropriate conclusions as well as new questions
- How to Communicate ideas clearly, both written and verbal
- How to use experimental data to write balanced chemical equations

Skills:

Student will be able to:

- ✓ Know the how to use moles as a universal unit of measurement for elements.
- ✓ Use the periodic table to identify the atomic mass and molecular mass of elements.
- ✓ Use the periodic table to calculate the mass of one mole of the element.
- ✓ Convert between mass, moles and numbers of atoms or molecules.
- ✓ Calculate balanced chemical equations from experimental data
- ✓ Be able to calculate the empirical formula from the percent composition.
- ✓ Be able to find the molecular formula given the empirical formula and the molecular mass.
- ✓ Use yield and state its importance
- ✓ Understand some historical figures such as Dalton, Gay-Lusaac and Avogadro
- ✓ Understand how to calculate moles of gases.

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Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

Stage 2 - Assessment Evidence

Performance tasks:

- Worksheet on calculating molecular and formula mass
- End of the unit exercises.
- Homework : calculating moles
- Classwork: writing equations based on given experimental data

Other Evidence:

- ✓ Two individual assessments (Mid-Term/Final) accounting for the assigned percentage of the overall course grade.
- ✓ Homework, participation, behavior and attendance.
- ✓ Grades based on presentation of knowledge and ideas.
- ✓

Stage 3 – Learning Plan

Learning Activities

- Lecture/Discussion/Overhead Presentation.
- White board.
- Small-group work/Cooperative Learning.
- Videos related to the subject.

How to use moles to write balanced chemical equations?

- Describe how to use moles to write balanced chemical equations
- Quiz on uses of using moles to write chemical equations

How to convert between mass, moles and numbers of atoms or molecules?

- Class discussion explaining these calculations
- Worksheets to practice conversion

Discuss in groups -

- How to use the information on a periodic table to calculate the mass of one mole of a substance?
- Why do we use moles?
- What is a yield and why is it important?
- Presentation on how is % error determined from % yield?
- What were Dalton, Gay-Lussac and Avogadro known for?
- How to calculate the volume of gas in reactions?
- Discuss the importance of predicting yield in the identification, mining and extraction of commercial ore deposits and Justify the increase in recycling of metals in our society and across the world

The Asian International School
Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019
Topic: Organic Chemistry

Stage 1 - Desired Results

Established Goals:

In this unit we will focus on basic structure, naming, functions, and reactions of various classes of organic compounds. Understand the unique properties of carbon. Understand Alkanes and their properties, Isomerism, the halogen compounds of alkanes. We will also understand the reactivity of the C=C double bond in alkenes. Enumerate the functional groups, compare methods of ethanol production and the reactions of ethanol.

Understandings:

Students will understand ...

- ✓ The constituents of an organic compound.
- ✓ Apply the naming and drawing conventions to describe different organic compounds.
- ✓ Compare and contrast the three types of hydrocarbons - alkanes, alkenes, and alkynes.
- ✓ Describe the range of molecular structures (e.g. straight vs. branched chains) found among organic compounds.
- ✓ Describe the physical structure of chemical isomers.
- ✓ compare methods of ethanol production and the reactions of ethanol
- ✓ Understand hazards of alcohol on health

Essential Questions:

- ✓ Why is carbon the most important element in your life?
- ✓ What are the different classes of organic compounds and how do they differ in structure and properties?
- ✓ How to name hydrocarbons?
- ✓ What kinds of reactions can carbon containing compounds undergo?
- ✓ How do functional groups affect the behavior of these molecules?
- ✓ What is isomerization and how does this affect the behavior of molecules?
- ✓ What are the reaction patterns of organic addition, substitution, and elimination reactions?

Knowledge:

Students will know ...

- How to make observations from a scientific perspective
- How to be knowledgeable about scientific concepts and theories
- How to be able to think scientifically and use scientific knowledge to make decisions in real world problems.
- How to Think analytically by evaluating evidence using relevant criteria ; develop appropriate conclusions as well as new questions
- How to Communicate ideas clearly, both written and verbal
- How to read, interpret & examine scientific claims
- How to pose questions & form hypotheses based on personal observations, scientific articles, experiments & knowledge

Skills:

Student will be able to:

- ✓ Define what constitutes an organic compound.
- ✓ Differentiate between properties of inorganic and organic compounds.
- ✓ Differentiate between alkanes, alkenes, alkynes, and cyclic hydrocarbons.
- ✓ Identify, name and draw structural formulas for the first ten alkanes.
- ✓ Recognize that many organic compounds contain functional groups, which determine the properties and uses of that compound.
- ✓ compare methods of ethanol production and the reactions of ethanol
- ✓ understand organic acids

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Unit Backward Design
Chemistry, TOEFL Beginner, 2018-2019

Stage 2 - Assessment Evidence

Performance tasks:

- Name various organic substances.
- Draw and name alkanes, alkenes, alkynes and aromatics (benzene, toluene)
- Essay type Exercises: What are the two different carbon-containing molecules that are important for living organism?
- Homework:
Identify functional groups worksheet.
- Inserting information into a table,
- Draw structures of functional groups.

Other Evidence:

- ✓ Two individual assessments (Mid-Term/Final) accounting for the assigned percentage of the overall course grade.
- ✓ Homework, participation, behavior and attendance.
- ✓ Grades based on presentation of knowledge and ideas.

Stage 3 – Learning Plan

Learning Activities

- Lecture/Discussion/Overhead Presentation.
- Small-group work/Cooperative Learning.
- Videos related to the subject.
- Interpreting an illustration/ lab skills
- Explanation on drawing and distinguish between saturated and unsaturated organic compounds_
- making Poster on effects of alcohol

Why is carbon the most important element in your life?

- Research and write an Essay
- Quiz on Name various organic substances.

What kinds of reactions can carbon containing compounds undergo?

- The unique properties of carbon
- Naming the first 10 alkanes.
- Identify reactions and complete the equation worksheets
- Experiment: making soap in the laboratory

Discuss in groups -

The carbon cycle.
Class discussion on Identifying examples of organic reactions.
Various organic products
Ethanol as a fuel