CHEMISTRY FACILITATION

for the

NEW LOWER SECONDARY CURRICULUM

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2024

Subject: CHEMISTRY

- **Subject code:** 545
- **Number of papers:** 2
- **Paper 1:** Theory – 545/1
- **Paper 2/3:** Practical – 545/2 or 545/3

The candidates will be assessed in knowledge, understanding, skills and attitudes/ values

Preview

This facilitation will be handled in three phases:

- Paper 1 section A
- Paper 1 section B
- Paper 2 (Practical)

Paper 1: 545/1

Format of the paper

- This is a **theory** paper.
- You will be assessed on your **knowledge**, **understanding** and appreciation of chemistry concepts - **values**.
- It will span all the four years of education.
- Items will be **scenario-based**.

Format of the paper…

- The duration of the paper is **two (02) hours**.
- It will be composed of **two sections** – A and B.
- It will have **six items**:
  - Two items in section A
  - Four items in section B
- You will attempt **four items** in total – 2 from each section

As we wait for other members to join us…

1. **Before you enter the exam room…**

- be prepared – (5Ps) Proper Planning Prevents Poor Performance
- be smart
- check for your stationery

2. **Before you open the question booklet…**

- read through the instructions
- pay attention to the time allocated

3. **During the exam…**

- remain calm
- read all the questions carefully
- ask for help but only from/ through the invigilators

SECTION A

- It comprises **two** items;
  - with **broken** tasks.
- Both items are **compulsory**;
- This section emphasises **knowledge**;
  - and **values** of course.
- Responses to be written in **spaces** provided;

Areas of assessment

There are **three** main areas on which assessment in section A will be based:

- Area 1 – Category
- Area 2 – Suitability
- Area 3 – Advice

However, each item is constructed from a different **element** of the syllabus; has a unique **approach**; and comes from specific **topics** (or even portions of a topic)

Section A topics

Item 1

Appreciate the application of chemistry in daily life

- Chemicals for consumers
  - Food additives
  - Medicines
  - Detergents
- Nuclear processes

Item 2

Appreciate the diversity and interactions of substances and their importance in life

- Elements, compounds and mixtures
- The periodic table
- Trends in the periodic table
- Structure and bonding
- Formulae, stoichiometry and mole concept
- Using materials
- Carbon in life – biogas, polymers & plastics
- Reactivity series – alloys
- Air – rusting and combustion

Section A approach

Item 1 approach	Basis of assessment	Item 2 approach
Identify category/ type	← **Category** →	Identify categories with reason and example
Function(s)/ how it works	← **Suitability** →	Properties/ characteristics/ prediction of trends – at least 4
Impact on environment/ life explained & mitigated - **one**	← **Advice** →	Evaluate the choice i.e. uses/ application - **one**
Evaluate the product/ process – similarity and difference - **one**		Impact on environment/ life & mitigation - **one**

Item 1 Example

Onyera lives in an area where they use borehole water. He slid and fell and his white shirt became dirty. He decided to use a **detergent** to clean his shirt. The shirt remained dirty with some brown spots yet he had rinsed it several times.

Task:

As a chemistry learner;

a) point out the problem Onyera made when choosing a product.
b) help Onyera understand how the product works
c) advise Onyera on the challenges associated with the long term use of the product

Responses

point out the problem Onyera made when choosing a product.

help Onyera understand how the product works

advise Onyera on the challenges associated with the long term use of the product

Identify category/ type

Onyera chose a soapy detergent instead of a soapless detergent

OR

Onyera should have used a soapless detergent instead of a soapy detergent

how it works

Detergents are surfactants and work by facilitating the emulsification and removal of grease.

A detergent has two parts – the alkyl tail which is fat-soluble and the head which is water soluble.

The fat-soluble part penetrates grease while the water-soluble part remains in water.

The grease is split up into tiny globules which are then carried away by the water.

Impact on environment/ life explained; mitigation; evaluate product – similarity and difference

[1]Soapy detergents contain chemicals which can cause irritation and redness of the eyes which is painful; this [2]can be resolved by washing the eyes with plenty of water.

[3]Both soapless and soapy detergents are effective cleaning agents with rain water (soft water). [4]However, soapless detergents are better cleaning agents in hard water because they do not form scum with it which saves both soap and water.

Lets look at some categories you may encounter…

identify category; evaluate – similarities and differences; know how it works/ functions; impact on the environment/ life & mitigation…

Detergents

- **soapy**
- **soapless**

Nuclear processes

- **fusion**
- **fission**

Medicines

Traditional and synthetic

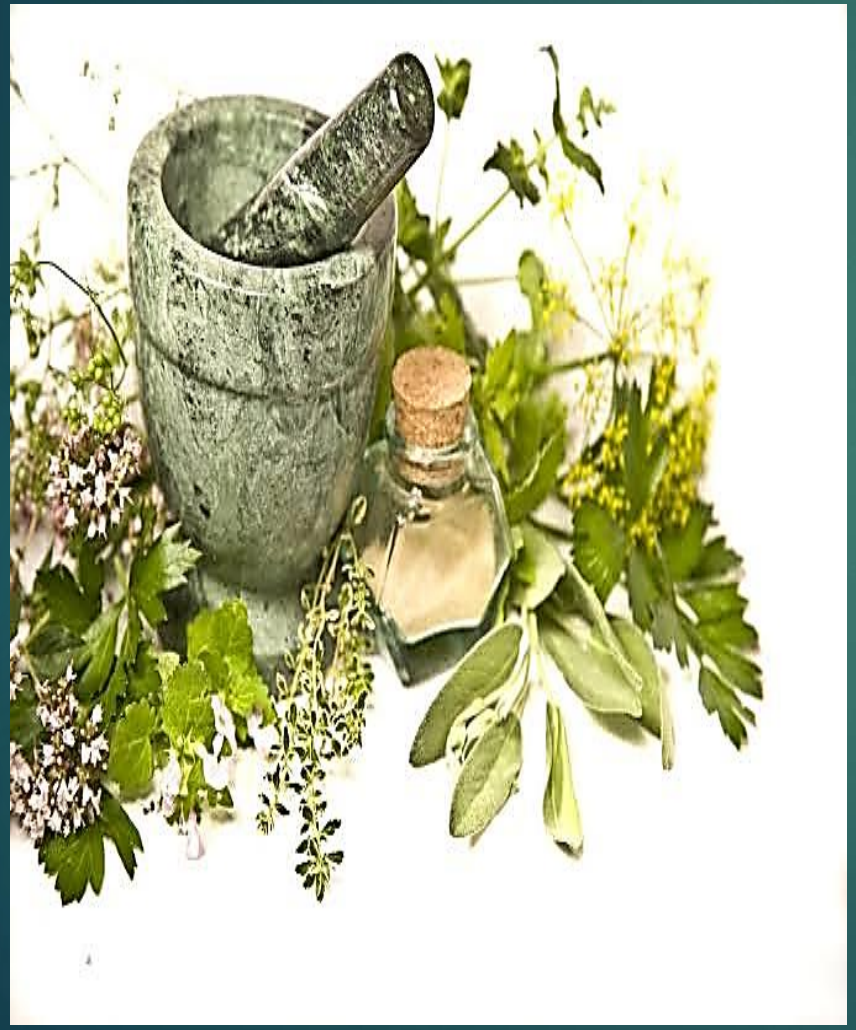
- **analgesics**
- **antibiotics**
- **psychotherapeutic**
  - **antidepressants**
  - **stimulants**
  - **antipsychotics**

Food additives

Synthetic and natural

- **preservatives; antioxidants**
- **flavouring agents**
- **Stabilizers; thickening agents**
- **dyes (food colour)**

Example 2 – for discussion



Nalumansi was visiting her grandmother in the village when she developed a body ache. Her grandmother picked some leaves from various plants which she squeezed and gave her. Nalumansi was hesitant at first and insisted on going to a health centre but when she took the liquid concoction, she felt significantly better.

Task:

As a learner of chemistry:

a) help Nalumansi's grandmother understand what Nalumansi expected

b) explain to Nalumansi why she felt better after she took the concoction

c) advise Nalumansi and her grandmother about the problems associated with the use of the product

Example 3 – take home

Both Catherine and Sandra own shops that sell home-made cookies and bread. People in the community prefer Sandra's cookies. Catherine decided to buy some cookies and bread from Sandra and realized that they had an appealing aroma, taste, appearance and lasted longer on the shelf. She is seeking help.

Task:

As a learner of chemistry:

a) explain the ingredients that are lacking in Catherine's cookies and bread

b) describe the suitability of these ingredients in the foods

c) what advice would you give to the consumers of Sandra's bread and cookies?

Item 2 example

Peter is in the process of constructing his house without affecting the environment. He wants to build a good strong house; there are various building materials of different quality and properties on the market. However, he does not know the quality of materials to use.

Peter knows that choosing quality materials depends on the nature of the material and has come to you for advice.

Task:

Use your chemistry knowledge to;

a) explain

   i. the categories of materials

   ii. the suitability of the materials

b) advise Peter on the choice of materials

Responses

explain the categories of materials

identify categories with reason and example

A material is a substance used to make an object;

Materials can be natural or artificial/ synthetic;

Natural materials come from living things for example wood while;

artificial materials are made by man for example plastics.

explain the suitability of the materials

properties/ characteristics

Iron is very strong so it can support heavy loads. ~~It is easy to mould into different shapes and has a high melting point to resist fires.~~

~~Wood is cheap and easy to get.~~ It is light when dry yet strong so it is easy to lift. However, if not treated, it can easily be attacked by termites.

Glass is transparent to allow light pass through and can give the house an attractive appearance due to a high refractive index.

advise Peter on the choice of materials

one use/ application; one danger to the environment/ life explained and mitigated

[1]Glass can be fixed as window panes in transparent windows that allow light through and in bathroom enclosures. [2]Glass is very brittle and easily breaks. It has sharp edges which can cause even deep cuts. Therefore, when installing glass one should [3]wear protective gloves and handle it with care.

Example 2

A group of youths have received money from the community development fund to set up a bakery. They need clearance from the district officials who have emphasized that they should use suitable and environmentally friendly packaging materials for their bakery products. The youths have organized a meeting to discuss possible packaging materials they can use to which you have been invited for consultation.

Task

Using the knowledge you have acquired in chemistry:

a) explain to the youths
   i. the categories of materials they can choose from
   ii. the suitability of the materials in packaging their products

b) help them defend their choice of material before the district officials

Let us look at possible categorisations in specific topics…

The periodic table

Categories: Metals and Non-metals

Suitability: Properties

Advice: Uses; impact; mitigation

Trends in the PT

Categories: Position of Metals and Non-metals

Suitability: Predicting properties in relation to position

Advice: Predicting uses; impact; mitigation

Reactivity series – alloys

Categories: Pure metals and alloys

Suitability: Difference in properties of pure metal and alloy

Advice: Uses of alloys; impact; mitigation

Possible categorizations in specific topics…

Bonding, structure and Properties of substances

Categories:

- Metallic/ giant metallic
- Ionic/ giant ionic
- Covalent/ giant molecular

Suitability: Physical properties

Advice: Uses; impact; mitigation

Using materials

Categories: Natural and synthetic

Suitability: Properties

Advice: Uses; impact; mitigation

Try to generate this information for the other topics mentioned

NOTE:

Remember, when categorizing: Identify; Define; Give example

A review of Section A

1. How many numbers will you find? – **two**
2. Where will you write the answers? – **in the spaces provided**
3. In how many areas will you be assessed? – **three areas**
4. What are the three areas in which you will be assessed? – **categorizing**, **suitability** and **advice**
5. When categorizing, remember to – **mention categories**, **define** and give **examples** where necessary
6. Suitability in item 1 will emphasize – **how it works/ function**
7. Suitability in item 2 will emphasize – **properties**; how many? At least **4**
8. Advice for item 1 is – one **impact explained**, **mitigated**; **similarity** and **difference**
9. Advice for item 2 is – one **use**/ application; one **impact explained** and **mitigated**

SECTION B

Overview

- This section will have **two parts –** part I and part II;
  - each part will have **two items**,
  - you will choose only **one**,
  - responses to the item will be written in answer booklets.
- The main objective of this section is to assess your understanding of the **application** of chemistry processes in our daily lives;
  - this will be shown in form of an **essay**

PART I: ITEMS 3 AND 4 – INDUSTRIAL PROCESSES

In the construction of this item, the examiner is assessing the learner's appreciation of the contribution of chemistry to the economy.

The topics you can expect in this part are:

- Industrial processes – manufacture of chlorine, sodium hydroxide, lime, cement, nitrate fertilizer (ammonium nitrate) and extraction of metals (**Fe**, Al, **Cu**)
- Carbon in life – distillation, making soap, fermentation (manufacture of ethanol)
- Air – manufacture of oxygen/ nitrogen
- Rates of reactions – manufacture of sulphuric acid
- Oxidation and reduction – as applied in the extraction of metals

In your responses to items 3 or 4…

1. Raw materials
2. Process of production
   - vessels/ apparatus
   - coherent; description of the process
   - conversion to the desired product
   - purification (if any)
3. Side effects of the process and their mitigation
4. Social benefits

Important tips

- The **side effect/ danger** must be identified, explained and mitigated or well explained and mitigated: 3 scores

  The **dust** produced in the cement factory can end up in the respiratory system of the workers and **cause respiratory complications** such as asthma. The workers must wear protection in form of **masks** to minimise this.

- The **social benefit** must be identified, effect of social benefit and impact given: 3 scores

  The people living around the cement factory can **get employment opportunities** at the factory and earn an **income**. This allows them to afford basic needs like shelter and education which improves their **standards of living**.

Important tips…

- Do not forget to show the chemistry i.e. write equations especially when describing the process of production:

  E.G. when describing the fermentation process…

  Under anaerobic conditions, an enzyme in yeast catalyses the conversion of glucose into ethanol

$$C_6H_{12}O_6 \xrightarrow{\text{zymase}} 2C_2H_5OH + 2CO_2$$

- You don't have to outline the vessels/ apparatus but embed them in your description
- Mention all the raw materials – you may not outline them but mention them within your description

Example

Illustration I

Air which is a mixture of different components contains 21% oxygen. Due to a wide spread of respiratory illnesses caused by COVID-19, there was an increased demand for oxygen by patients in hospitals. The government supply of oxygen is not enough and is planning to set up an oxygen production plant with minimal environmental impact. However, the science club members in your school would like to know how the process of production will be carried out.

Task:

As chemistry student, make a write up you will use during the presentation.

Response

Raw materials Liquid air / Air.

Process of production

Air is passed through air filters to remove dust and smoke particles.

It is passed through concentrated sodium hydroxide solution to absorb/ remove carbon dioxide and water vapour.

Equation for

It is also passed through silicon(IV) oxide / silica gel to absorb water vapour.

Carbon dioxide and water vapour are removed from air before it is liquefied because they solidify and block the apparatus when the air is cooled.

Response

Process of production…

The air is repeatedly compressed, allowed to rapidly expand and cool until it turns into a pale blue liquid at about -200°C.

The liquid air is fractionally distilled using a fractionating column / tower.

Nitrogen boils off first because it has a lower boiling point (–196°C) leaving behind oxygen with a higher boiling point (–183°C).

Both nitrogen and oxygen collected obtained contain traces of noble gases.

Pure oxygen is then stored under pressure in steel cylinders.

1. **Can you write down a well explained side effect and its mitigation?**
2. **Explain one social benefit -** identify, effect and impact

PART II: ITEMS 5 AND 6 – NATURAL RESOURCES

The construction of this item wants you to bring out the existence of natural resources in the environment and their importance in daily life.

Expect items to come from the following areas:

- Air – nitrogen in air used to make fertilisers; oxygen for a variety of uses; and other components
- Water – as a resource
- Rocks and minerals – gems and raw materials for construction industry
- Carbon in the environment – fuels, carbon dioxide in the environment, water hardness
- Fossil fuels – sources of energy and useful materials E.G. hydrogen from natural gas

What is expected from the learner:

1. **Mention what (natural) resources are; identify the categories – renewable and non-renewable; defined (reason) and examples given**
2. **Give the composition of the natural resources**
3. **From the scenario –**
   - identify the activit(ies) affecting the natural resources
   - describe how it occurs and
   - how it affects resources (environment) and
   - how the effect can be mitigated
   - **Use equations wherever possible**
4. **Explain the importance/ benefits of any one natural resource**

Example

Osukuru village in Tororo district is at the foot of Tororo rock. People of this village have for a long time practiced charcoal burning, animal husbandry, crop husbandry and stone quarrying. Recently, the animals have started dying and wells are drying up yet the little water available is not fresh. The locals are now wondering why all these are happening.

A sensitization workshop is to be organized to explain the existing situation in the village. The theme of the work shop is **MY ENVIRONMENT MY RESPONSIBILITY**.

Task:

As a chemistry student, write a massage you will deliver upon invitation.

Guide

1. What is a resource? What are the types of resources? Give examples of each –
2. Identify impact of an activity on the environment; describe how it occurs; how it is mitigated
3. Mention any one benefit of the natural resource

NB: Keep in line with scenario and task

TIPS FOR SECTION B

- When making the write-up, **start from anywhere**. There is no particular order in which to write your essay. Just make sure that you write about each of the items we have highlighted. You do not need to use subheadings.

- Much as the item may require you to make presentations, or write letters and things of that sort, **do not waste your time on the formalities** like greeting, attack the item direct.

- You may find the scenario items quite lengthy but take time to **read**, **understand**, **relate** (find key areas) and **write**, write, write, write;

Tips for section B…

- Look for responses within the **support material**. This will save you the headache of recalling what you learnt in your lessons. And there's just enough responses you can draw from the support material

- Please do not forget the chemistry. Write **equations**

Have you noticed that the items in Section A and Section B part I revolve around a given topic but in section B part II, the items revolve around many topics which have been integrated into one task.

As you prepare for your exams…

- The key difference between section A and B is that with section B, the item is not broken up into several tasks.
- Experience has shown that nothing beats **discussions**. And as a discussant, you benefit most.
- During your class activities, draw **flow charts** of industrial processes showing what is happening at each stage. This will help you to visualize the process rather than cram it.

For my fellow teachers:

1. Embrace technology in your teaching – AI, YouTube videos…
2. Involve practicals in your lessons as much as possible. They make learning concrete
3. At this point, no one is yet to claim custodianship of this new curriculum:
   - take time and study the syllabus book – UNEB is not going to deviate from it,
   - note that there is a difference between learning outcomes and suggested learning activities – be creative, come up with your own activities – you know your learners better
   - learning is a continuous process, be ready to learn, relearn and unlearn; embrace criticism;
   - join Whatsapp groups, attend seminars, share information with colleagues; invest in learning – money and time

Teachers…

5. Carefully analyse the syllabus, you will realise that there is some content that is repeated in several topics. Plan appropriately to teach it once so that you save time.
   - You don't have to follow the syllabus book topic per topic; some topics have been placed far apart yet they are closely related. If you space them, you may find yourself wasting time reviewing a long gone topic just because the learners need that information to understand this topic you are tackling.
6. Let us work together with the debate clubs in our schools, helping them generate debate motions along topics in the curriculum. Work with the environment clubs. Educate is doing a good job as well. Do I need to mention the science clubs – that's us, let us revive them and use them to promote learning. Of course and all the other clubs – writers, scripture union, wildlife, agriculture…

END

wish you the best in your exams