Candidate's Name: .....

Signature: .....

Random No.						Personal No.		

(Do not write your School/ Centre Name or Number anywhere on this Booklet.)

545/1
CHEMISTRY
Paper 1
Oct./Nov. 2024
2 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

CHEMISTRY

Paper 1

2 hours

INSTRUCTIONS TO CANDIDATES:

This paper consists of **two** *Sections;* **A** *and* **B.**

It has **six** *examination items.*

Section **A** *has* **two compulsory** *items.*

Section **B** *has* **two** *Parts*; **I** and **II**. Answer **one** *item from* **each** *part.*

Answer **four** *items in all.*

Answers to Section **A must** *be written in the spaces provided while those of section* **B must** *be written on the answer booklet(s) provided.*

Any additional item(s) answered will **not** *be scored.*

Use where necessary;
Ca = 40; C = 12; O = 16; 1 mole of a gas occupies 22.4 dm^3 at s.t.p.

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SECTION A

Answer **both** *items from this section in the spaces provided.*

Item 1.

During the second world war, the cities of Hiroshima and Nagasaki in Japan were bombed using the most lethal weapon of the time, which caused massive destruction as shown in figure **1**. However, the energy that was used can be useful in the treatment of cancerous growths in humans. Up to now the impact of the bombing is still being felt in Japan.

Fig. 1
https://www.pennlive.com

Task:

As a learner of Chemistry;

(a) identify the type of bomb used.

_____

_____

_____

(b) suggest any other use of the form of energy that was used in the bomb.

_____

_____

_____

_____

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(c) explain the other danger associated with the form of energy in the bomb and give its mitigation.

Item 2.

An industry wanted to produce lime for treatment of acidic soils. The production of lime involves heating limestone strongly which results into its decomposition according to the equation;

$$CaCO_{3\,(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$$

The industry is also interested to know how much gas is evolved during the process since the gas is useful.

Before the production, an experiment was performed where 25 g of limestone were heated until there was no further change. You have been contacted for help.

Task:

As a learner of Chemistry;

(a) explain the categories of the products.

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(b) suggest the properties of the gaseous product that make it useful in daily life.

(c) calculate the volume of the gaseous product measured at *s.t.p*, that was formed.

(d) explain the impact of one of the products on the environment.

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SECTION B

Part I

Answer **one** *item from this part in the answer booklet(s) provided.*

Item 3.

In Uganda, copper wires are used mainly for transmitting electric power. To ensure the availability of wires, the government is considering setting up a copper production plant in a certain area. However, the residents of the area need to be sensitised about the industrial processes, social benefits, side effects and how they can be overcome.

Your head teacher has been identified to sensitise the residents.

Task:

As a learner of Chemistry, prepare a write-up that your head teacher will use to sensitise the residents.

Item 4.

Cement is one of the most commonly used building materials. In order to meet the high demand of cement in Uganda, many cement factories have been set up across the country, one of which is shown in figure **2**.

You are part of the Chemistry class that visited one of the factories and the process of producing cement was explained to the class. You have been invited to a radio talk show to explain how cement is produced.

After your presentation one of the callers wants to know whether there is any impact associated with the process you have talked about.

Fig. 2

https://thelocal.ug/wp-conent/uploads

Task:

Make a write-up of the sensitisation message up to the end of the talk show.

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Part II

Answer one item from this part in the answer booklets provided.

Item 5.

Peter, the cattle keeper, grazes his cattle on a community land. During the dry season, he practices bush burning and also takes his cattle to drink water from the community water source. Peter's practices have raised concern in the community.

The area chairperson has organised a meeting to create awareness for Peter and the community.

Task:

As a learner of Chemistry make a write-up of the message the chairperson will present to the community.

Item 6.

During her school holidays, Eva visited her aunt who works at a stone quarry. She noticed that explosives were being used to blast big rocks to form small stones (aggregates) and there was a lot of dust rising into the air as shown in figures **3** and **4**.

Fig. 3

Fig. 4

https://www.google.com/url

Besides the social benefits, Eva was concerned about what would happen to the site and community if the activity continued over time.

Task:

As a learner of Chemistry, make a write-up to respond to Eva's concern.

END

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ITEM 1

a) Atomic bomb.

b) ~~Used to~~ form of energy is Nuclear fission
- Used to generate electricity for homes and bussinesses
- usedin Industrial applications, in food stabilization and material testing.
- Nuclear reactions generate steam for turbines, producing electricity.

c) Increased risk of Cancer from radiation exposure, mitigated by radiation monitoring and exploring radiation techniques
- Nuclear blast causing destructions of houses, homes, mitigated by storing nuclear materials safely
- Environmental polution through radioactive waste, hence harms the ecosystem, mitigated by treating the radio active waste before disposal.

ITEM 2

a) The product is a covalent compound, because it is formed by sharing of electrons between non-metalic atoms, that is Carbondioxide. hence a gaseous product.

Another product is an ionic compound, because it is formed by transfer of electrons from metal atom to a non-metal atom, that is Calcium oxide. hence its solid product.

b) - Used in fire extinguishers and fire suppression systems since it is non-flammable.

- Carbondioxide reacts with water forming Carbonic acid therefore used in pH control in water treatment.
- Carbondioxide is compressible and used in industrial processes hence allows for efficient storage and transportation.

c) $CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$

1 mole of $CaCO_3$ produces 1 mole of CO_2

molar mass of Calcium Carbonate

$CaCO_3 = 40 + 12 + (16 \times 3)$

$= 100g$.

1 mole of CO_2 contains 22.4 litres

100g of $CaCO_3$ produces 22.4 litres of CO_2

25g of $CaCO_3$ produces $\left(\frac{22.4}{100} \times 25\right)$ l of CO_2

$= 5.625$ litres

d) Considering impacts of Carbon dioxide to the environment.

- Excessive Carbon dioxide emissions contribute to green house effects, mitigated by use of renewable energy to reduce emissions

- Carbon dioxide release in the atmosphere leads to ocean acidification, disrupting ecosystems, mitigated by use of renewable energy like solar energy.

ITEM 3

Raw materials used:
Copper pyrites ($CuFeS_2$)

Process of production:

The ore (copper pyrites) is crushed into powder and mixed with water containing special oils called frothing agents.
The air blown into the mixture and a froth forms. Earthly impurities in the ore are wetted with water and sink to the bottom of the flotation tank while copper pyrites floats on the surface as froth.
The froth is skimmed off, and an acid added into it to break it. The ore is filtered off, dried and roasted to convert it to ~~copper(I)~~ Copper(I) sulphide, Sulphurdioxide and iron(II) oxide.

$$2CuFeS_{2(s)} + 4O_{2(g)} \longrightarrow Cu_2S_{(s)} + 2FeO_{(s)} + 5SO_2$$

Sand is then added ~~and~~ in the mixture heated in absence of air to convert iron(II) oxide to iron(II) silicate liquid

$$FeO_{(s)} + SiO_{2(s)} \longrightarrow FeSiO_{3(l)}$$

The ore is then heated in a controlled amount of air to produce impure copper and sulphur dioxide

$$Cu_2S_{(s)} + O_{2(g)} \longrightarrow 2Cu_{(s)} + SO_{2(g)}$$

The copper produced is then purified by electrolysis of copper(II) sulphate using this produced impure copper as the anode and a pure copper as the ~~ano~~ cathod.
The impure copper anode dissolves in the electrolyte producing copper(II) ions which move to the cathod where they are discharged to pure copper.

Reactions at anode

$Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e$

Reactions at Cathode

$Cu^{2+} + 2e \longrightarrow Cu_{(s)}$.

Side effects of the process of extraction.

- Release of sulphur dioxide causes air pollution resulting in to acid rains that affect plant growth and cause global warming, mitigated by treatment of the gas.

- Exposure to copper fumes or dust can cause poisoning leading to cancer and even death mitigated by personal protective equipments.

Social benefits.

- Source of employment opportunities, hence improved income and therefore better standards of living.
- Increased government revenue through taxes hence improving of infrastructure such as roads, schools leading to development of the society improving standards of living
- Provision of market for goods of the community members hence generating income, leading to better lives.

ITEM 4

Raw materials;

Sand, limestone and clay

Process of production.

- The limestone obtained from the quarry is mixed with sand and clay in the correct proportion and crushed into a fine powder.

The powder is then ~~crushed~~ mixed with water and allowed to flow down a rotating tank where it is strongly heated at about 1500°c.

The limestone decomposes into calcium oxide and carbon dioxide

$$CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$$

The calcium oxide reacts with sand forming calcium silicate and also reacts with aluminium oxide forming calicium aluminate

$$CaO_{(s)} + SiO_{2(s)} \longrightarrow CaSiO_{3(s)}$$

$$CaO_{(s)} + Al_2O_{3(s)} \longrightarrow CaAl_2O_{4(s)}$$

Calcium silicate and aluminate form a mixture called clinker.

Gypsum is added to moderate the setting of cement and the lamps are then crushed by machine ~~by to~~ obtain cement powder.

$$\text{Clinker} + CaSO_4 \cdot 2H_2O \longrightarrow \text{Cement}$$

Side effects of the process of production

- Carbon dioxide emissions to the atmosphere can cause global warming, this is mitigated by recyling of ~~carbondio~~ carbon dioxide.
- Inhalation of air contaminated by cement dust causes respiratory diseases, mitigated by weaving personal protective equipments.

· Social benefits:

- Source of employment opportunities, hence improved income and therefore better standards of living.
- Increased government revenue through taxes hence improvement of infrastructure such as roads, schools leading to development of the society.
- Production of cement for use during construction by the community members, hence acquiring better houses.

ITEM 5.

Category :; Natural resource

Renewable Natural resources are those which can be replenished or replaced naturally over time for example water, pasture, wild life.

Composition of Natural resources

- water contains an element of hydrogen, and oxygen.
- Rocks contains minerals, iron ores, copper and others
- Vegetation contains trees, grass, big animals as well as microorganisms, pollutants from mans activities.

Impacts

- Cattle wastes contaminates community water sources, posing health risks like cholera. mitigated by regulating water quality monitoring also water conservation measures and laws to the community members
- Overgrazing can lead to soil erosion, reducing fertility, mitigated by rotational grazing, re-vegetation and also promoting soil conservation techniques.
- Bush burning destroys habitats, having wild life, mitigated by wild life friendly grazing practices.
- Also bush burning releases Carbon dioxide to atmosphere leading to global warming and climate changes. mitigated by use of renewable energy to reduce emissions.

- Water borne diseases from contaminated water causes health risks to the community, mitigated by proper disposal of wastes in the water, also treatment of water before use.

- Bush burning reduces livestock productivity due to over grazing caused by reduced pasture quality, mitigated by re-vegetation.

Social benefits of natural resource

- Water supplies clean drinking water contributing health and well-being.
- Water supports irrigation for agriculture, contributing to food security and economic growth improving peoples standareds.
- Government revenue through taxes on fishermen, sells persons generating money used in development of other sectors like health sector, transport sector there improving standareds of living of people in the community

- Pasture supports livestock grazing and increases livestock productivity products like milk hence improving well being and life of community members.

ITEM 6.

Category of Natural resource

Rocks and mineral are non renewable resources because they can not be replaced by natural processes in life time.
They are categorised as Igneous, Sedimentary, metamophic.

- Igneous rocks, comprising of minerals like Quartz, feldspar.
- Metamophic rocks composed of minerals like ~~Calcite~~, Quartz, clay, feldspar.
- Sedimentary - composed of minerals like clay, Quartz, calcite.

Impacts:

- Habital destruction due to stone quarrying activities leading to biodiversity, mitigated by conducting environmental impacts and implementing habitat re-vegetation

- Quarrying releases dust and chemicals to air leading to air born diseases, mitigated using suppression systems like spreading water to reduce dust, also use of protective equipments

- Chemicals from quarrying contaminate water sources leading to death of aquatic animals hence reducing on their number, mitigated by treatment of water before disposal also recycling wastes.

Machines during stone quarying generate excessive noise which may affect the mental health of the community members, mitigated by creating sound barriers like wall fencing and also shedule blasting during sensitive hours

- Quaring leads to soil instability and erosion affecting crop productivity and poor crop yields, mitigated by implementing soil erosion control measures.

Social benefits of Rocks

- Creates employment opportunities and people earn income, improving their standareds of living
- Rocks are broken into hard core used as materials for construction of roads, houses.
- Generation of government revenue ~~and~~ local governments, generating money used to develop other sectors like transport sector hence improving standareds.
- Usually help in formation of soil by a process of weathering.

Thanks
for any addition, subtraction.
Am open to discussion.

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