

553/I BIOLOGY
SCORING GUIDE
SECTION A

Item one

Tasks

Identify the plant structures affected by the prevailing conditions in the gardens of the two farmers.

The plant structures affected include:

Leaves	phloem	any 3 structures = 03 scores
Stems	accept xylem	
Flowers	stomata, buds	

Explain how the conditions in Peter's garden were responsible for the delayed yields.

(05 scores)

The much dust from the milling machines covered surfaces of leaves, blocking the stomata, affecting gaseous exchange, hence reduced respiration and photosynthesis. *(02 scores)*

The dust on the leaves also reduced light absorption by chlorophyll in the chloroplasts of the leaves, which reduced the rate of photosynthesis leading to slow accumulation of sugars hence stunted growth. *(03 scores)*

Dust blocks stigma preventing pollen grains on stigma from pollination

How did John's maize manage to give yields before that of Peter?

Mitotic cell division in the damaged leaves, buds and flowers allowed regeneration of affected parts/structures to allow photosynthesis, growth and production of fruits.

Increased photosynthesis lead to production of more leaves and flowers to replace what was destroyed by caterpillars.

The maize developed more prop roots to increase absorption of water and mineral salts hence growth.

Any two well explained = 02 scores

Only one well explained = 01 score

No correct response = 00 scores

TOTAL SCORES FOR ITEM ONE = 10 SCORES

Item two

Task

How did the old woman's body co-ordinate to make her release the hot saucepan?



The heat from the saucepan stimulated thermo-receptors in the skin which generated an impulse fired to the spinal cord via sensory neurons. In the spinal cord, impulses form the sensory neuron were passed via a synapse to the relay neuron, then via another synapse to the motor neurons. The impulses were then transmitted from the motor neurons to the effector muscles of the arm, causing them to contract, hence releasing the hot saucepan.

(06 scores)

Point out the causes of the health conditions present in the old woman

<i>Causes of Diabetes (any type)</i>	<i>Causes of osteoporosis</i>
Failure of the pancreas to produce insulin hormone	Old age (menopause)
Insensitivity of the liver cells to insulin produced	Poor diet (lacking in Ca^{2+} , K^+)
Failure to produce ADII in the body	Less active lifestyle / less physical exercise
Faulty kidneys/nephrons	Some medical conditions like cancer, IIIV c.t.c
	Alcoholism
	Cigarette smoking

<i>Condition</i>	<i>Score</i>
2 causes for Diabetes + 2 for Osteoporosis	03
1 cause for each	02
Causes for only one disease	01
No correct cause	00

How can the old woman improve her health conditions to live a better life?

Increased intake of foods rich in Calcium, fluoride and phosphorous

Increased intake of foods rich in Vitamin D

Nutritional supplements from the hospital

Regular medical check-ups

Doing regular exercises

Taking insulin injections

Avoiding high carbohydrate meals

Taking enough water

(03 scores)

Condition	Score
Any 5 strategies and above	03
Any 3 to 4 strategies	02
Any 1 to 2 strategies	01
No correct strategy	00

TOTAL SCORES FOR ITEM TWO = 12 SCORES

Item Three

Task

Using scientific facts, clearly show to Raphael the possibility of producing a son with such a condition, from him and Jane.

The son is suffering from Haemophilia. This is a disease caused by a recessive allele carried on the X chromosome.

Jane should be a heterozygote/carrier for the disease, though Raphael is normal.

Let H represent the allele for normal blood condition

Let h represent the allele for bleeding condition

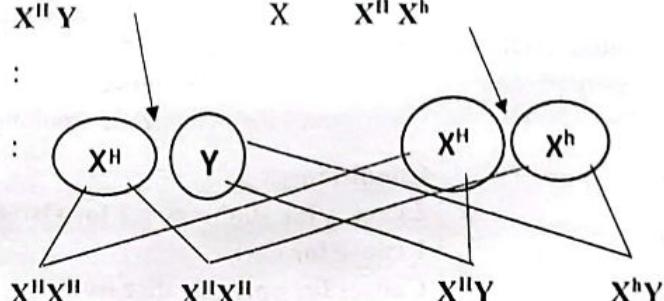
Parental phenotypes : normal man X normal woman

Parental genotype : $X^H Y$ X $X^H X^h$

Meiosis :

Gametes :

Random fertilization :



Offspring phenotypes: 2 normal girls, 1 haemophiliac boy and 1 normal boy

(06 Scores)

What are the likely effects of the son's condition on his life?

Nose bleeds that take a long time to stop.

Bleeding from wounds that lasts a long time.

Bleeding gums.

Skin that bruises easily.

Pain and stiffness around joints, such as elbows, because of bleeding inside the body (internal bleeding)

Permanent damage e.g arthritis in the joints

Painful and prolonged headache.

Fainting
Delayed wound healing
Stunted growth

Condition	Score
Any 5 effects and above	03
Any 3 to 4 effects	02
Any 1 to 2 effects	01
No correct effects	00

(03 scores)

Advise the couple on how to manage Raphael's health status.

counselling to revive self esteem

Blood transfusion to maintain a high blood volume

Frequent medical checkup for white blood cell/CD4 count

Starting antiretroviral therapy/ARVs

Early treatment of other diseases like cough

Joining/forming AIDS awareness/sensitization groups/NGOs to maintain a high self-esteem.

Having protected sex to keep Jane safe.

Avoid multiple sexual partners to avoid re-infection

(03 scores)

Condition	Score
Any 5 strategies and above	03
Any 3 to 4 strategies	02
Any 1 to 2 strategies	01
No correct strategies	00

TOTAL SCORES FOR ITEM THREE = 12 SCORES

SECTION B

PART I

Notes to Scorers:

The essays to items in this part should be well paragraphed and should include

Paragraphs indicating ----- problem identified

(03 x 3 scores = 9 scores) ----- problem well explained

--- natural resources affected by the problem (3 natural resources, 2 living, 1 non-living)

Paragraphs explaining:-----solutions or conservation measures

(@1x3 = 3 scores)

Paragraphs explaining:----benefits of conservation or value of natural resources conserved to life forms (@1 x 3 = 03 scores)

ITEM FOUR

Task:

Analyze the problems surrounding Robert's land and show him how to overcome them. Convince Robert on the advantages of maintaining such areas in their natural state.

Problems surrounding Robert's Land are as explained below (Learner should explain each problem and show a set of natural resources affected by the problem)

Deforestation

Encroachment

Habitat destruction

Loss of biodiversity

Human-animal conflicts

The above problem can be overcome as explained below: (any 3)

Afforestation

Raising a stronger and higher fence

Using repellants that can keep off esp reptiles

Relocating to a more environmentally less damaging land

The advantages of maintaining such places in their natural states are as highlighted below:

(any 3)

Forests are habitats to several animals like monkeys, snakes, etc which ensures their survival

Forests are breeding grounds for several animals and insects which increases their numbers

The forest and other vegetation participate in rainfall formation, which rain fall supports proper plant growth

Forests act as carbon sinks, purifying air utilized by man and other animals

Forests are sources of foods to several animals and man in form of fruits.

ITEM FIVE

Task:

Explain the problems in Banda, suggest how the residents can overcome them, and show them the value of conserving the natural environment.

Possible problems: (should be well explained, with a set of natural resources affected on each)

Encroachment

Swamp reclamation

Devegetation/deforestation

Global warming/increased temperatures

Flooding

Soil erosion

Habitat destruction

Loss of biodiversity

How to overcome the above problems (any 3 = 03 scores)

Afforestation/planting green vegetation

Digging drainage channels

Strict laws against encroachment

Relocating people from the swamp

The value of conserving the natural environment (benefits of a swamp) (any 3 = 03 scores)

A swamp is a breeding ground for several animals like amphibians, reptiles and fish which increases their numbers

A swamp is a habitat/home for several organisms like fish, reptiles e.t.c which ensures their survival

A swamp acts as a water catchment area for large water bodies like lakes and rivers which are habitats for aquatic life forms.

The swamps act as carbon sinks, purifying air utilized by man and other animals during respiration

Swamps participate in the rain cycle through precipitation, forming rainfall which supports proper plant growth

Swamps are sources of food in form fish to man

PART II

Notes to scorers

For essays in this part (E.C 3), the candidate should bring out all indicators as guided by the task. These should include

----description of processes involved

----role of various structures/organs involved in the processes

----activities taking place (including materials and products) within the structures

----challenges/problems and how they are overcome

TOTAL SCORES FOR ITEMS 6 & 7 = 15 SCORES EACH

Item six

Task

Explain how Jane's body functioned after the nurse's intervention to bring about the effects after 40 minutes. Justify the observations made after the race and explain how the body gained normal state.

Expected Response

Jane's body functioned as explained below:

Jane licked glucose, which was ingested into the body through the mouth, and through the stomach and duodenum to the ileum where it was absorbed across the villi into the blood stream.

After 40 minutes, the blood glucose levels increased, and since Jane has symptoms of Diabetes, the body could not regulate the blood glucose, leading to losing some in the urine.

Losing glucose in urine lead to as well loss of more water in the urine since the urine components were more concentrated. This resulted into Jane urinating a lot, and consequently feeling thirsty due loss of water from the body as urine.

Jane as well felt hungry after 40 minutes since she was losing glucose molecules in urine, yet her body needed glucose to produce energy to replenish the body after the race.

The observations made after the race were muscle pain and heavy breathing. These arose as explained below:

During the race, the body's energy demands required more oxygen than what the body could supply. This created an oxygen debt, and so the body resorted to respiring anaerobically. This produced lactic acid, whose accumulation in the muscles caused muscle pain.

The heavy breathing was an effort by the body to try and provide much oxygen and as well remove carbondioxide.

The body gained normal state as explained below.

After the race, the heavy breathing continued so as to supply enough oxygen to the body to pay the oxygen debt, and as well oxidize the lactic acid to less toxic products of carbondioxide and water. This reduced the muscle pain, and the breathing normalised as more carbondioxide was removed out of the body reducing toxicity.

Item Seven

Task

Mention Daniel's Health problem and clearly explain how his body contracted it. Advise Daniel on how he can recover from the problem discovered later in the course of the treatment.

Expected Responses

Daniel has lung cancer.

His body contracted it by continuous inhalation of cigarette smoke from his smoking friends as described below.

While inhaling the smoke from the friends;

Daniel's external intercoastal muscles contracted, while the internal intercoastal muscles relaxed.

The diaphragm muscles relaxed, and so it flattened.

This increased the volume in the thoracic cavity, and its pressure reduced below atmospheric pressure.

This forced the air containing cigarette smoke from the friends to rush inside Daniel' lungs through the trachea, bronchioles and finally into the alveoli.

At the alveoli, the tar in the cigarette smoke coated the air passages, blocking them. This consequently resulted into formation of an abnormal ball of cells at the blocked sites, which resulted into lung cancer.

(12 scores)

The problem discovered later in the course of the treatment was that Daniel's blood could no longer load enough oxygen. He can recover from this by:

Avoid being in company of smoker to stop inhaling smoke containing CO

Adhering to medical treatment

Feeding on diet rich in iron to boost formation of more red blood cells in the body

Feeding on a balanced diet to maintain a healthy body

Staying in a well aerated environment.

(03 scores)

Good oral hygiene

END

Conclusion(CN)	Gives a conclusion relevant to the scenario (Knowing how to handle the various categories of tools, machines, material and being score mindful of the workshop environment can save one from injury).	Relevant conclusion 1 No conclusion 0 score
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Item 2.

In a bid to electrify all parts of Uganda the government seeks to utilize locally available sources which may lead to inconveniences such as relocation of citizens. Being educated about the available sources, vast uses and mode of handling of the energy will help citizens appreciate the government's initiative.

Task:

Write an article to be put on the national newspaper to educate fellow Ugandans.

2	Understand energy, electricity and introduction electronics. (1)	Provides a focused knowledge about; Sources of electricity Uses of electricity How to handle electricity. Identify the problems	Provides a relevant introduction identifying the need. Lack of knowledge about;			Identifying problems 3 problems - 3 score 2 problems - 2 score 1 problems - 1 scores None - 0 scores
			In explanation mentions the sources, type and requirements;			
	Sources of electricity mentioned	source	Types of energy	Requirements	For each source, mentioning source, energy type and requirements	3 4 - 3 scores 2-3 - 2 scores 1- 1 score 0 None - 0 score
	-Solar -Hydro -Biogas -Wind energy	(SE) AS	Sun. (1score) Solar (1score) Invertors. (1score)	Solar panels. (1score) Mounting system. (1score) Battery storage. (1score) Cables. (1score) Electrical accessories. (1score)		
		water	Hydro			

E1

Score 2: If the procedure is completely relevant
Score 1: If the procedure is partially relevant
Score 0: If the procedure is irrelevant/wrong/not there

NOTE: Accept an experiment on water retention or drainage.E2

Score 2: If the procedure is completely coherent
Score 1: If the procedure is partially coherent Score 0:
If the procedure is irrelevant/wrong

E3

Score 2: If all variables were completely managed
Score 1: If some variables are managed Score 0:
0: If no variable is managed

Observation/ Results (F)

Score 2: If observations are completely accurate
Score 1: If observations are partly accurate Score 0: If observations are inaccurate/wrong

Competence 6: Explanation/interpretation of results (G)

From the investigation, soil sample R is slightly acidic and has a higher percentage of air while soil sample M is alkaline and has a low percentage of air. Living things in the soil need oxygen for survival, also the roots of the plants need oxygen for respiration, when a soil has less air, the living organisms will die and plants roots will fail to absorb nutrients, this will cause poor plant growth leading to poor yields such as in Joseph's Garden. A high pH may also be unfavorable for plant growth and survival of soil living things. James's garden that had favorable conditions supported plant growth hence leading to high yields.

Score 2: If explanation makes complete meaning
Score 1: If explanation makes partial meaning Score 0:
If explanation does not make meaning

Competence 7: Conclusion/recommendation/advice (H).

Beans need soils with neutral or slightly acidic pH and enough air, for proper growth so as to produce good yields. Joseph should choose another garden for growing beans in the next season./ accept applying organic manure or lime

Score 2: If conclusion is relevant
Score 1: If conclusion is partly relevant
Score 0: If conclusion is wrong/irrelevant/not given

ITEM 2

Competence 1: Identification using observable features (A) Specimen II is an insect

Reasons: It has 3 main body divisions, It has a pair of antennae, it has a pair of wings,

Score 3: If gives at least 4 correct features with 2 from each at least.

Score 2: If gives 2-3 correct features with at least one from each specimen
Score 1: If gives only 1 correct feature from any of specimen

Competence 2: Adaptation to function/survival (B)

It has a thin flattened body that enables it to fit through narrow places such as between the books. It has a pair of long, flexible antennae for sensing in the dark.

It has a pair of sharp, strong mandibles for cutting books

Score 2: if gives 2-3 adaptations

Score 1: if gives 1 adaptation

Score 0: if gives no adaptation or wrong adaptation

Add:

Dull colored body for camouflage

Segmented body for flexibility

Competence 3: Drawing skills (C1)

*****drawing of the hind limb of a cockroach

Score 3: If 2/3 of drawing skills are reflected

Score 2: If half of drawing skills reflected Score 1:

If only one drawing skill reflected Score 0: If no drawing skill is reflected

C2- labelling

Score 2: If 2/3 of relevant parts labelled

Score 1: If 1/2 of relevant parts is labelled

Score 0: If all parts labelled are irrelevant or no label

END

553/3 BIOLOGY

(PRACTICAL)

SCORING GUIDE

ITEM 1

Competence 1: Aim of the experiment (A)

An experiment/investigation to determine the nutrient composition of the food sample T and investigate the effect of substance L on the food sample T using the different liquids X, Y, Z

Score 2: If the title is correct

Score 1: If title is partially correct

Score 0: If the title is incorrect or not written

Competence 2: Hypothesis (B)

Substance L has an effect on food sample T in presence of an appropriate liquid medium

Or

Substance L has no effect on food sample T, with or without a liquid medium

Score 2: If hypothesis is correctly stated

Score 1: If hypothesis is partly correct

Score 0: If hypothesis is incorrect or not written

Competence 3: Variables (C)

Controlled variables:

Volumes/quantities of solutions (T and L) and reagents

Temperature (of incubation)

Time (of incubation in water bath)

Score 2: If any two variables are stated correctly

Score 1: If only one of the variables is stated correctly

Score 0: If variable is incorrect or not written

Competence 4: List of apparatus/materials/ requirements (D)

Solutions, food sample T and substance L

Reagents: (Iodine solution, Benedict's solution, Sodium hydroxide solution, Copper(II) sulphate solution, DCPIP solution, dilute hydrochloric acid solution)

Test tubes

Dropper

Plastic beaker

Thermometer

Test tube holder

Hot water and Heat source

Score 3: If all and only the relevant materials have been listed

Score 2: If 1 irrelevant material has been mentioned among the relevant ones

Score 1: If 2 or more irrelevant materials have been mentioned among the relevant ones

Score 0 : If only irrelevant materials mentioned or none mentioned

Competence 5: Procedure (E) & Observations (F)

Determining the nutrient composition of food sample T

Test	Procedure	Observations /results	Deductions
Starch test	To 1cm ³ of solution T in a test tube, added 3 drops of iodine solution	Turbid solution turned to brown solution	Starch absent
Protein test	To 1cm ³ of solution T in a test tube, added 1cm ³ of sodium hydroxide solution, followed by copper(II)sulphate drop wise	Turbid solution turned to purple solution	Proteins present
Reducing sugar test	To 1cm ³ of solution T in a test tube, added 1cm ³	Turbid solution turned to blue solution and persisted on boiling.	Reducing sugars absent

	of Benedict's solution and boiled.		
Vitamin C test	To 1cm ³ of DCPIP solution in a test tube, added drops of solution T	The purple solution remained	Vitamin C absent

Investigating the effect of substance L on food sample T using three liquids X, Y and Z

Three test tubes were labelled as X, Y and Z and in each, 2cm³ of solutions X, Y and Z were put respectively.

2cm³ of food sample T were put in each of the three test tubes, followed by 2cm³ of substance L respectively.

Hot water was put in a plastic beaker, and its temperature was adjusted by adding cold water until it was 38°C, making a water bath.

The three test tubes X, Y and Z were put into the water bath, and were left to stand for 40 minutes, while maintaining the temperatures between 37-40°C.

After 40 minutes, a protein test was carried out on the contents of each of the three test tubes X, Y and Z as shown below.

Procedure for Protein Test	Observations made for			Deductions
To 1cm ³ of solution from either test tubes X, Y or Z in a test tube, added 1cm ³ of sodium hydroxide solution, followed by copper(II)sulphate solution drop wise	Test Tube X	Turbid solution turned to purple solution		Proteins present
	Test Tube Y	colorless solution turned to blue solution		Proteins absent
	Test Tube Z	Turbid solution turned to purple solution		Proteins present

Score grid for Procedure (E) and Observations (F)

E1

Score 2: If the WIOLE procedure is completely relevant

Score 1 If the procedure is partially relevant

Score 0: If the procedure is irrelevant/wrong/or not there

E2

Score 2: If the WHOLE procedure is completely coherent

Score 1: If the procedure is partially coherent

Score 0: If the procedure is totally not coherent/wrong/or not there

E3

Score 2: If ALL controllable variables were managed

Score 1: If controllable variables were partly managed

Score 0: If no variables were controlled/managed

Observations/Results (F)

Score 2: If ALL observations are completely accurate

Score 1: If observations are partly accurate/correct

Score 0: If no correct observations are made

Competence 6: Explanation/interpretation of results (G)

Food sample T contains proteins, and substance L is an enzyme, which breaks down proteins to simpler foods. However, this occurs within a liquid medium, which acts as an optimum PII medium for the enzyme activity. For this investigation, liquid Y provided the best PII medium for the action of the enzyme in substance L to break down proteins in food sample T to polypeptides. Therefore proteins were absent in test tube Y after incubation. The water bath provided an optimum temperature for the enzyme activity.

Other liquids X and Z did not provide the best PII medium for the activity of the enzyme in L to break down the proteins in Sample T to polypeptides. Therefore, the proteins were present in them after incubation.

Score 2: If explanation makes complete meaning

Score 1: If explanation is partially meaningful

Score 0: If no correct explanation made

Competence 7: Conclusion/recommendation (H)

Food sample T is a protein food, while substance L is an enzyme, which works best in a liquid medium Y to break down the proteins to more easily digestible and high nutritional compounds.

I recommend farmers therefore to use liquid Y when mixing their feeds for good results

Score 2: If conclusion is relevant

Score 1: If conclusion is partly relevant

Score 0: If no relevant conclusion is made

Specimen	Identity	Region of the back
A	Thoracic vertebra	Chest region
B	Cervical vertebra	Neck region
C	Lumbar vertebra	abdominal region

Differences between specimen B and C

Specimen C (lumbar vertebra)	Specimen B (cervical vertebra)
Large centrum	Small centrum
Long transverse processes	Short transverse processes
Broad and flat neural spine	Narrow, short neural spine
Narrow neural canal	Wider neural canal

Score 3: If all specimens correctly identified with correct regions and two differences given

Score 2: If only two specimens identified correctly, with correct regions and one difference

Score 1: If only one specimen is identified with/without region or differences or only differences given

Score 0 : If no identification is done with no correct differences

Competence 2: *Adaptation to function/survival (B)*

Specimen B (cervical vertebra) has;

Hard neural arch for protection of spinal cord

Transverse processes for attachment of neck muscles for support

Wider neural canal for passage of the spinal cord

Neural spine for articulation with other vertebrae

Centrum for firm articulation with adjacent vertebrae

Vertebral canals for passage of blood vessels to the head

Divides transverse processes for increasing S/A for muscle attachment.

Score 2: If at least two correct adaptations are given

Score 1: If only one correct adaptation is given

Score 0: If no correct adaptation is given

Competence 3: *Drawing skills (C)*

A drawing of the external features of specimen B (cervical vertebra)

C1

Score 3: If drawing reflects more than half of the drawing skills (T,D,M,N,O)

Score 2 If drawing reflects only half of the drawing skills (T,D,M,N,O)

Score 1: If drawing reflects less than half of the drawing skills (T,D,M,N,O)

Score 0 : If no drawing is made or drawing reflects no drawing skill

C2 Labelling

Score 2: If more than half of the relevant parts are labelled

Score 1 If half of the relevant parts are labelled correctly

Score 0: If no part is labelled correctly

END

**545/1 CHEMISTRY
SCORING GUIDE**

Section A

(a) Beverage additives because they enhance soda (or one good use of any one component of soda) Food additive, Citric acid is a preservative, Sugar sweetens the product, Carbonated water flavours / preservative/

Soda helps to quench thirsty and provide a refreshing drink.

Offers a variety of flavours and tastes.

Often consumed in social settings like gatherings and parties and this enhances socialization.

Helps give energy since it contains sugars.

- Excessive soda consumption may result into various health issues such as obesity, diabetes, tooth decay, nutrient imbalance, caffeine overload, therefore moderate consumption of it is encouraged as part of balanced diet.

- Citric acid protects the soda from oxidation and spoilage and also maintains pH level preventing it from becoming too alkaline.

Carbon dioxide from carbonated water helps prevent spoilage by creating an environment that is less favourable to microbial growth.

Sugar adds sweetness making it tasty and pleasant and also gives quick energy boost thus making a popular choice for those seeking rapid energy lift.

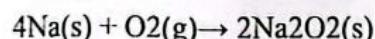
(a) It is Sodium atom, a group (I) metal found in period 3 of the periodic table because it has one electron in its outermost energy level and has three energy levels ie 2:8:1

It is a highly electropositive element and forms stable ions of the formula Na^+ by losing its only one electron in its outermost energy level.

- It reacts vigorously with water forming a silvery ball that floats above water surface producing a hissing sound and forming a colourless (alkaline) solution.



It readily burns in oxygen forming a white or yellow solid.

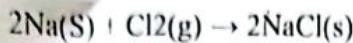


It readily burns in chlorine forming a white solid of sodium chloride. (table salt).

It is soft and can be cut with a knife

Has a low melting point

Low density



-It is used for making salts e.g sodium chloride (used as a food additive, in the process of making soap, helps to treat wounds in the mouth).

As a liquid coolant in nuclear power stations.

Used in street lighting lamps. (sodium vapor lamps).

Essential element in nerve functioning

Production of metals like titanium and gold.

(d) Reacts violently with water, oxygen and acid igniting spontaneously in moist air so it should be stored under oil. Handle with care, protective gadgets

Highly corrosive to eyes, skin and mucous membranes, so protective masks should be worn during its manufacture.

Any 1 (1 + 1 = 2)

SECTION B. Part I

The acid is sulphuric acid. Raw-materials.

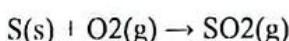
Sulphur

Oxygen

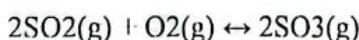
Water

Procedure;

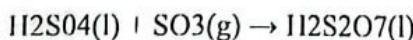
Sulphur is extracted from its ground deposits by the Frasch process. The sulphur is then burnt in oxygen to produce sulphur dioxide.



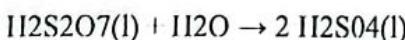
The dust free (purified) sulphur dioxide is reacted with more oxygen at a temperature of 450°C and pressure of atmosphere in the presence of atmosphere in the presence of Vanadium (VI) oxide, sulphur trioxide is formed.



Sulphur trioxide is then dissolved in concentrated sulphuric acid to form oleum



Oleum is then added to correct amount of water to form 98% concentrated sulphuric acid.



Side Effects and mitigation.

Gaseous fumes (sulphur dioxide and sulphur trioxide) are dangerous once they escape into the environment, so safety precautions to be put in place to ensure that the gases should not escape into the environment.

If sulphuric acid is inhaled, it can cause severe respiratory problems, so one should wear protective masks and clothes.

Social Benefits.

The industry provides employment opportunities to the community where they get money and improve on their standards of living.

The sulphuric acid from the industry can be used as an electrolyte for vehicle batteries which helps in transportation of goods and services and people from one place to another.

Sulphuric acid can be used in the manufacture of fertilizers, paints, dyes, artificial fibers, detergents which are used for various purposes.

4. Raw materials.

- Water

Sodium chloride solution.

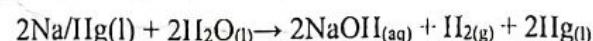
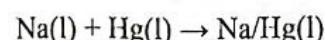
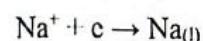
Procedure;

Sodium chloride crystals are obtained from salty water of the lake by evaporation using heat from the sun which floats as a white solid on top of water. It is then skimmed off and transferred into a water trough where it is dissolved in required amount of water to make brine.

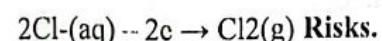
The brine is then electrolysed between mercury cathode and carbon anode.

At the cathode, both sodium ions and hydrogen ions move to the cathode but sodium ions are preferentially discharged forming sodium which combines with mercury to form sodium amalgam.

The sodium amalgam is then dissolved in water to form sodium hydroxide solution and mercury with evolution of hydrogen gas.



At the anode, both hydroxide ions and chloride ions migrate there but chloride ions are preferentially discharged because they are present in much concentration. These lose their electrons to the anode forming neutral chloride radicals which combine in pairs to form chlorine gas.



- During the process of manufacture of sodium hydroxide, both chlorine and hydrogen gases are produced and they are very dangerous, that is poisonous and explosive respectively, so one should ensure that they are collected in respective gas cylinders.
 - Sodium hydroxide is a highly corrosive substance that can cause severe burns and ulcers upon skin contact. So one should wear protective gears.
 - Inhaling sodium hydroxide fumes can cause respiratory issues such as pulmonary edema, bronchitis, asthma. So one should wear masks.
- Uses of NaOH.**
- Making soap
 - Making paper i.e used to treat wood and remove lignin.
 - Used in textile industries to manufacture viscose and mercerize cotton.
 - To make medicines such as aspirin.
 - Used in many cosmetic products such as oil polish, hair dyes and hair straightening products.

Part II

Trees are natural resources that provide renewable carbon fuels because they can be obtained within a short period of time after they have been used. Trees consist of carbon majorly, water and nitrogen, lignin which resists compression.

Cutting down trees may result into increased amount of carbon dioxide in the atmosphere which may lead to global warming.

Reafforestation increases the number of trees which during photosynthesis use carbon dioxide reducing its concentration in the atmosphere and release oxygen gas that is used for respiration. $6CO_2(g) + 6H_2O \rightarrow C_6H_{12}O_6(S) + 6O_2(g)$

Benefits

Trees provide us with timber that can be used for making furniture and roofing houses.

Trees provide us with wood and charcoal used as fuel in homes and producing electricity in industries.

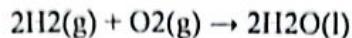
Trees help to reduce global warming by reducing the amount of carbon dioxide which is one of the greenhouse gases, by absorbing it.

Trees provide us with oxygen gas that supports lives.

Trees act as wind breakers and this helps in formation of rainfall.

Swamps contain water which is a natural renewable resource that can easily be obtained after being used.

Water consists of hydrogen and oxygen chemically combined together.



Therefore, constructing an acid manufacturing plant may result into water pollution due to refuse from industries and also gases as sulphur dioxide and sulphur trioxide may end up dissolving in water making it acidic.

So, the investor should treat the refuse before releasing it into the water. Also, safety measures should be put into place so that the gases are not released into the atmosphere. In this way, the local community and the investor will live peacefully.

Uses of water.

Essential component in homes that is used for cooking, drinking and cleaning.

Acts as habitat for aquatic animals.

Helps in movement of nutrients and oxygen in plants.

Helps to remove waste products and also proper digestion of food.

Irrigates crops.

Used in production of hydro- electric power.

Used in industries for manufacturing and construction processes.

END

545/2 CHEMISTRY

SCORING GUIDE

Item 1.

In a large shopping mall, the outdoor walkways and entranceways have recently become heavily stained due to high foot traffic. The cleaners in this mall have developed a cleaning mixture that consists of a soap solution and hydrogen peroxide for restoring the appearance of the walkways and entranceways.

However, there is need to increase the frothing of the mixture for effective cleaning process and one of substances *X* and *Y* is to be used for this purpose.

The cleaners are not sure which of the substances *X* or *Y* is a better frothing agent.

You are provided with;

substance *X*

substance *Y*

soap solution

hydrogen peroxide solution

some apparatus

Task:

Design an experiment to help the factory workers address their concern.

Aim: To find out which substance *X* or *Y* is better frothing agent / cleaning agent.

Variables :

v Independent : Time or

Dependant : Length of froth or

Controlled : Volume of mixture

1 amount of substance *X* and *Y*.

Substance *X* or *Y* time for the maximum froth

Mass / amount of volume of mixture.

Hypothesis : *X* is a better frothing agent than *Y*, *X* forms a froth in shorter time than *Y*

X is better than *Y*

X is better cleansing agent.

Procedure.

The whole amount of spatula endful half a spatula of Y was added to boiling tube 3cm³ of a mixture of H₂O and soap was added to the mixture using a stop clock watch started.

The length of the froth was measured and recorded using a ruler after interval of 5 seconds to up to 30 seconds

The product was repeated using substance X

A graph of length of froth against time was plotted.

(b) Carry out the experiment and record your data

Procedure II

X is put a boiling tube

3cm³ of mixture is added to the X using a measuring cylinder and at the same time 2 stop clock started.

The time taken for a maximum froth to be reached is recorded.

The procedure is repeated using substance Y

Risks and Mitigations.

Hydrogen peroxide is corrosive - wear gloves

Eye irritation by soap - wear glasses

Breakage of apparatus - for boiling tube restable with care.

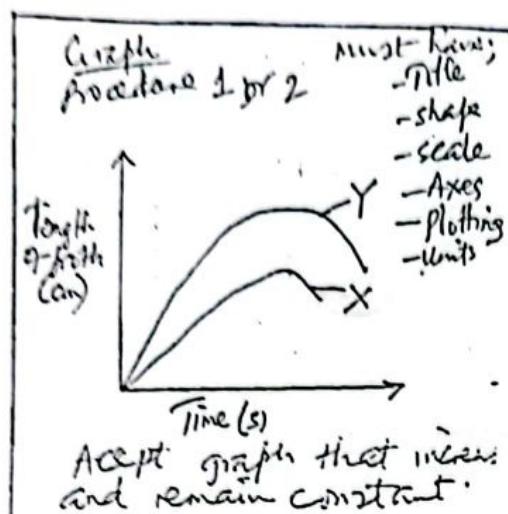
Record of data.

Time(s)	00	5.0	00	15.0	20	25	25	30
Length of froth (cm)	00	7.0						
Substance	Y	00	7.0	10.0	12.0	12.0	100	9.0
	X	00	4.0	5.0	7.0	8.0	8.5	7.0

Analyse your data and draw a conclusion.

Procedure II

Substance(g)	X (MnO ₂)	Y (PbO ₂)
Time for maximum froth (s)	20.0	15.0



Procedure II Data analysis

Y takes 15 seconds to reach the maximum

X takes 20 seconds to reach the maximum,

Conclusion

Y is better frothing agent than X

END

545/3 CHEMISTRY**SCORING GUIDE****Item 1.**

Magnesium Sulphate (Epsom salt) is used as a fertiliser to stimulate root growth and development.

A local factory is planning to prepare the fertilizer on a small scale by reacting magnesium metal and dilute sulphuric acid.



The factory workers are concerned on how the speed of the reaction can be improved at room temperature.

You are provided with:

Magnesium ribbon

Dilute sulphuric acid

Some apparatus

Task:

(a) Design an experiment to help the factory workers address their concerns.

Aim: An Experiment to investigate / conduct / determine effect of concentration of sulphuric on rate of reaction.

Hypothesis: Increase concentration rate of reaction.

Variables

Dependent: Time (rate of reaction) for mg to disappear.

Independent: concentration of acid(Volume of acid)

Controlled: length of magnesium is kept constant by measuring / using same length. Or Volume of mixture is kept constant by adding water to give a total volume as 35cm³

Risks and Mitigations:

acid burns in contact on skin - wear gloves / protector gears

choking smell of gases - wear masks

Volume of acid	35	30	25	20	15	10
Volume of water(cm ³)	0	5	10	15	20	25
Time (s)	10.5	16.5	23.0	34.5	45.0	60.0
$\frac{l}{t} \text{ (S}^{-1}\text{)}$	0.095	0.061	0.045	0.029	0.022	0.07

(b) Carry out an experiment and record your data.

Procedure:

magnesium ribbon is cut unto five pieces of equal length of 2cm.

35cm³ of dilute sulphuric acid is measured using a measuring cylinder and put into a beaker.

One piece of magnesium is added to dilute acid in the beaker and stop clock immediately started.

The beaker is swirled and time taken for magnesium ribbon to react completely is noted.

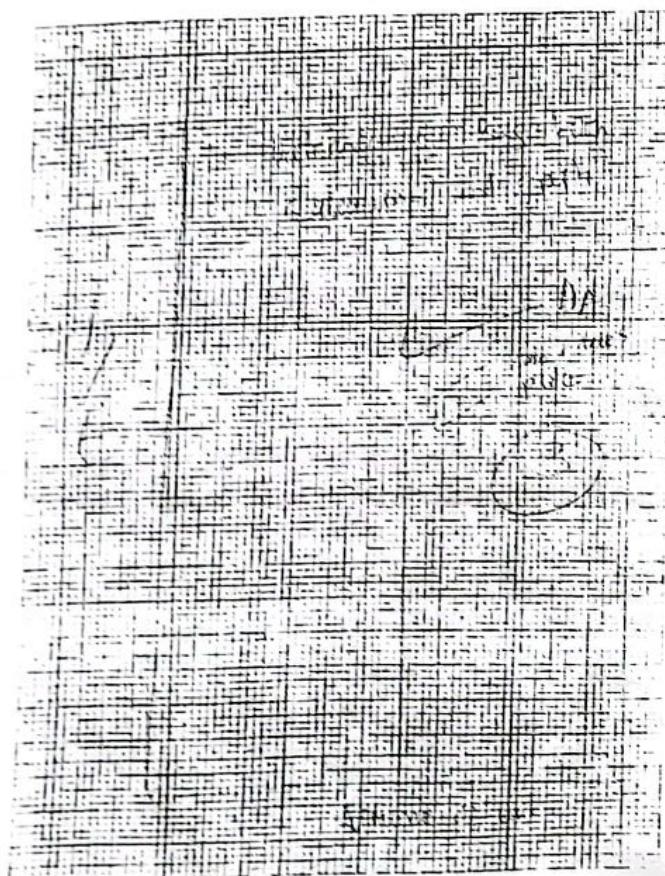
The experiment is repeated with different volumes of acid as 30, 25, 20 and 15cm³ and each time adding water to give total volume of mixture as 35cm³

A graph of $\frac{i}{time}$ against volume of acid used is plotted.

(c) Analyse your data and draw a conclusion.

Conclusion

Increase in concentration increases rate of reaction.



END