

EXPECTED RESPONSES

Item 1

Basis of assessment:	Assessment criteria:
(a) (i) Category + Reason + Example	<ul style="list-style-type: none"> • Materials can be natural or synthetic. • Natural materials are God made, exist in nature, its formation is not influenced by man Examples include: rocks, sand, wood, paper, water, air • Artificial/synthetic materials are man-made. Examples include: Iron bars, plastics, concrete.
(ii) Properties of materials	<p>Plastics</p> <ul style="list-style-type: none"> • Water proof • Resistant to chemical/weather attack • Very strong/high tensile strength • Tough/hard • Light • Durable/long lasting/do not rust • Poor conductor of heat/electricity • Easily moulded into different shapes and sizes <p>Paper</p> <ul style="list-style-type: none"> • Lightweight • Cheap • Poor conductor of electricity • Easily moulded into different shapes and sizes • Tears easily • Poor weather resistance • Recyclable
(b) Advice on use Part 1: Reason for use	<ul style="list-style-type: none"> ✓ Plastics are water proof and thus, more appropriate for use in making packaging materials readily affected by water. This also makes them long lasting. ✓ Plastics are light and thus, more appropriate for use in making packaging materials since this facilitates easy carrying of the packed products. ✓ Paper is biodegradable and thus, cannot pollute the environment. ✓ Paper is made from renewable resources (trees) which can be replenished naturally. ✓ Papers are light and thus, more appropriate for use in making packaging materials since this facilitates easy carrying of the packed products.

Part 2: Impacts of material on the environment + Mitigation	<ul style="list-style-type: none"> ✓ Plastics are non-biodegradable/don't decompose hence, pollute the soil and water. This lowers soil productivity. Chlorinated plastics release harmful chemicals into the soil and hence, into the groundwater. This can be mitigated through recycling/reducing its usage/use biodegradable plastics. ✓ Paper in landfills litters the environment and affects the surrounding ecosystems. And when combined with other piled wastes, they decompose and produce unhealthy amounts of greenhouse gas and hence global warming. This can be mitigated by recycling/re-using it. ✓ Paper production contributes to deforestation, as trees are cut down to make wood pulp. This increase amounts of carbon dioxide in the atmosphere and hence global warming. This can be mitigated by planting trees that grow and mature so fast.
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Item 2

Basis of assessment	Assessment criteria
(a) Category	<ul style="list-style-type: none"> ✓ Joan used soapy detergent while Priscilla used soapless/synthetic detergent
(b) Functions of product/how the product works	<ul style="list-style-type: none"> ✓ Soap acts by lowering the surface tension between dirt and water. This is because soap molecule is made up of two parts: water-soluble part (hydrophilic) and dirt-soluble part (hydrophobic). The hydrophobic part of the soap penetrates/dissolves the dirt while the hydrophilic part of the soap dissolves in water. With constant agitation, dirt is dislodged from the fabric and carried away by the water.
(c) Advice on use Part 1: Danger/side effect of product to life/environment and mitigations	<ul style="list-style-type: none"> ✓ Soapy/soapless detergents cause skin irritations/blisters/burns on the top layer of a sensitive skin due to the chemical in them. This can be mitigated by using them with care/wear protective gears when using them/irrigate the affected area with a lot of water. ✓ Soapless detergents cause water pollution due to the phosphates which accelerate the growth of algae. This can be mitigated by enforcing strict laws on those who was near the water bodies. ✓ Some detergents can cause damage to the fabric due the excessive alkalis they contain. This can be mitigated by

	limiting/minimize/use controlled amounts of detergents (or wash the fabric with a lot of water).
Part 2: Evaluation based on similarities and differences	<p>Differences:</p> <ul style="list-style-type: none"> ✓ Soapless detergents wash effectively in both soft and hard water while soapy detergents wash effectively in only in only soft water. ✓ Soapless detergents clean effectively in acidic media while soapy detergents cannot. ✓ Soapless detergents are usually non-biodegradable while soapy detergents are usually biodegradable. ✓ Soapless detergents wash brighter than soapy detergents. <p>Similarities</p> <ul style="list-style-type: none"> ✓ Both are sodium/potassium salts of long chain organic acids. ✓ Both are effective cleansing agents in soft/rain water. ✓ Both have similar structures: consisting of a hydrophilic head and hydrophobic tail. ✓ Both remove dirt and stains out of the clothes through similar chemical mechanism/lowering the surface tension between the dirt and water.

Item 3

Basis of assessment	Assessment criteria
(a) (i) Category • Reason • Example	<ul style="list-style-type: none"> • Materials can be natural or synthetic. • Natural materials are God made, exist in nature, its formation is not influenced by man Examples include: rocks, sand, wood, water, air • Artificial/synthetic materials are man-made. Examples include: Iron bars, plastics, paint, concrete.
(ii) Properties of materials	<p>Iron bars</p> <ul style="list-style-type: none"> • Very strong/high tensile strength • Malleable • Ductile • High melting point • Tough/hard • Durable if well maintained • Good weldability <p>Aluminium</p> <ul style="list-style-type: none"> • Very strong/high tensile strength • Malleable • Ductile

	<ul style="list-style-type: none"> • Resistant to corrosion • High melting point • Tough/hard • Durable if well maintained • Good weldability • Light <p>Wood</p> <ul style="list-style-type: none"> • Strong/high tensile strength • Light weight when dry • Sound absorption/absorbs sound/sound proof (reduces noise pollution) • Poor electrical conductor when dry/poor conductor of heat • Tough/hard • Durable/long lasting if well maintained • High/good workability • Renewable • Resistant to chemical attacks 	
(b) Advice on use Part 1: Reason for use	<p>✓ Because iron bars are strong/durable/tough/malleable and thus, can be used to make frames.</p> <p>Or</p> <p>✓ Aluminium is resistant to corrosion and does not rust, rot or deteriorate when exposed to moisture. Thus, can be used to make frames.</p> <p>✓ Since, aluminium is light, this makes it reduce the weight on the buildings.</p> <p>Or</p> <p>✓ Because wood is strong/durable/tough and thus, can be used to make frames.</p>	
Part 2: Impacts of material on the environment + Mitigation	<p>✓ Iron readily rusts. The rust contaminates both the soil and water stream. The rust is also harmful to plants, animals and humans. This can be mitigated by recycling/re-using it.</p> <p>✓ Wood is obtained from cutting down of trees. This leads to accumulation of carbon dioxide and other greenhouse gases and hence, global warming/climate change results. Its also leads to loss of habitat for other living organisms (animals and birds). Its affects water cycle (evaporation levels are disrupted and drying up of moisture in the air hence decrease precipitation) and less rainfall/drought results.</p>	

	<p>This can be mitigated by planting trees that grow and mature so fast</p> <ul style="list-style-type: none"> ✓ When released into the water bodies, aluminium is toxic to gill-breathing animals such as fish and invertebrates since it causes damage to their gills, liver and kidneys. This can be mitigated by recycling/re-using it.
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Item 4

Basis of assessment	Assessment criteria
(a) Category	✓ Aspirin is a medicine which is an analgesic
(b) Functions of product	✓ Aspirin is a pain killer that reduces inflammation and relieves pain.
(c) Advice on use Part 1: Danger/side effect of product and mitigation	<ul style="list-style-type: none"> ✓ Aspirin causes headaches/allergic reactions and hence, lack of attention and concentration. This can be mitigated by limiting its use/seeking medical attention/stop their use. ✓ Natural painkillers like turmeric causes ulcers/indigestion/dizziness/nausea/stomach upset. These make a person uncomfortable. This can be mitigated by limiting its use/seeking medical attention. ✓ Coconut oil is comedogenic; causes clogging of the pores which results into blackheads/whiteheads. This can be mitigated by limiting its use/seeking medical attention
Part 2: Evaluation based on similarities and differences	<p>Differences:</p> <ul style="list-style-type: none"> ✓ Local medicines have less side effects/less toxic and thus, are safer compared to the synthetic medicines. ✓ Dosages and delivery of local medicines are not well known (have varying dosages) while synthetic medicines have precise dosages and delivery methods <p>Similarities</p> <ul style="list-style-type: none"> ✓ Both relieve pain/have side effects.

Item 5

Basis of assessment	Assessment criteria
(a) (i) Category • Reason • Example	<ul style="list-style-type: none"> • Materials can be natural or synthetic. • Natural materials are God made, exist in nature, its formation is not influenced by man Examples include: rocks, sand, wood, water, air • Artificial/synthetic materials are man-made. Examples include: iron bars, plastics, paint, concrete.

- Very strong/high tensile strength
- Malleable
- Ductile
- High melting point
- Tough/hard
- Durable if well maintained
- Good weldability

Aluminium

- Very strong/high tensile strength
- Malleable
- Ductile
- Resistant to corrosion
- High melting point
- Tough/hard
- Durable if well maintained
- Good weldability
- Light

Wood

- Strong/high tensile strength
- Light weight when dry
- Sound absorption/absorbs sound/sound proof (reduces noise pollution)
- Poor electrical conductor when dry/poor conductor of heat
- Tough/hard
- Durable/long lasting if well maintained
- High/good workability
- Renewable
- Resistant to chemical attacks

Bricks (clay/concrete)

- Strong/high tensile strength
- Tough/hard
- Durable/long lasting if well maintained
- Resistant to chemical/fire attacks
- Renewable

Concrete

- Strong/high tensile strength
- Poor electrical conductor/poor conductor of heat/fire resistant
- Tough/hard

	<ul style="list-style-type: none"> • Durable/long lasting if well maintained • High/good workability • Good compressive strength <p>Plastics</p> <ul style="list-style-type: none"> • Water proof • Resistant to chemical/weather attack • Very strong/high tensile strength • Tough/hard • Light • Durable/long lasting/do not rust • Poor conductor of heat/electricity • Easily moulded into different shapes and sizes
(b) Advice on use Part 1: Reason for use	<p>✓ Plastics are can be used for plumbing because they are water proof.</p> <p>Or</p> <p>✓ Because iron bars are:</p> <ul style="list-style-type: none"> • strong/durable/tough/malleable/ductile and they, can be used to make door and windows • versatile, they can be used for roofing, making doors and windows <p>Or</p> <p>✓ Aluminium is resistant to corrosion and does not does not rust, rot or deteriorate when exposed to moisture. Thus, can be used to make door/window frames.</p> <p>✓ Since, aluminium is light: this makes it reduce the weight on the buildings.</p> <p>Or</p> <p>✓ Because wood is strong/durable/tough/light and thus, can be used to make frames, roofing etc</p>
Part 2: Impacts of material on the environment • Mitigation	<p>✓ Plastics are non-biodegradable/don't decompose hence, pollute the soil and water. This lowers soil productivity. Chlorinated plastics release harmful chemicals into the soil and hence, into the groundwater. This can be mitigated through recycling/reducing its usage/use biodegradable plastics.</p> <p>✓ Iron readily rusts. The rust contaminates both the soil and water stream. The rust is also harmful to plants, animals and humans. This can be mitigated by recycling/re-using it.</p> <p>✓ Wood is obtained from cutting down of trees. This leads to accumulation of carbon dioxide and other greenhouse</p>

	<p>gases and hence, global warming/climate change results. It also leads to loss of habitat for other living organisms (animals and birds). It affects water cycle (evaporation levels are disrupted and drying up of moisture in the air hence decrease precipitation) and less rainfall/drought results.</p> <p>This can be mitigated by planting trees that grow and mature so fast.</p> <p>✓ When released into the water bodies, aluminium is toxic to gill-breathing animals such as fish and invertebrates since it causes damage to their gills, liver and kidneys. This can be mitigated by recycling/re-using it.</p> <p>✓ Concrete increases the pH of the soil which affects plant growth and contaminates ground water. This can be mitigated by recycling/re-using it.</p>
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Item 6

Base of Assessment	Assessment criteria
(a) Category	<p>✓ Food additives such as flavours, enhancers, food colouring, preservatives, emulsifiers, tomatoes, onions, citric acid among others</p>
(b) Functions of product	<p>✓ Food enhancers-increase the power of a flavour</p> <p>✓ Colours - enhance appearance or add colour.</p> <p>✓ Artificial sweeteners - increase the sweetness.</p> <p>✓ Emulsifiers - stop fats from clotting together.</p> <p>✓ Food acids (e.g. oranges, lemons, citric acid): impart different flavours and taste to foods/maintain the right acid levels.</p> <p>✓ Antioxidants - prevent foods from oxidising, or going rancid</p>
(c) Advice on use Part 1: Danger/side effect of product and mitigation	<p>Some people are sensitive/allergic to particular food additives and hence reactions like diarrhea/skin irritations/nausea/abdominal pain/headaches/vomiting etc. These make a person uncomfortable. The above can be mitigated by limiting its use/seeking medical attention/stop their use. Reading the food labels and check the ingredients list to make sure you are aware of any potentially harmful ingredients.</p> <p>✓ Acid additives lower the pH of the stomach and this can lead to ulcers. The above can be mitigated by limiting its use/seeking medical attention/stop their use.</p> <p>✓ Emulsifiers increases blood pressure and obesity due to high cholesterol in them</p>

	<p>The above can be mitigated by limiting its use/seeking medical attention/stop their use.</p> <ul style="list-style-type: none"> ✓ Some preservatives such as sodium nitrate and sodium nitrite may increase the risk of cancer and other illnesses. ✓ Many of these additives and preservatives are made from petroleum-based chemicals, which can contaminate the air, water, and soil. Furthermore, some preservatives and chemicals used to enhance the colour or flavour of food are known endocrine disruptors, meaning they can affect the hormone levels and reproductive system in animals. ✓ Natural painkillers like turmeric causes ulcers/indigestion/dizziness/nausea/stomach upset. These make a person uncomfortable. This can be mitigated by limiting its use/seeking medical attention.
Part 2: Evaluation based on similarities and differences	<p>Differences:</p> <ul style="list-style-type: none"> ✓ Natural food additives have less side effects/less toxic and thus, are safer compared to the synthetic food additives. ✓ Natural food additives are chemical compounds extracted from plants, animals or minerals while synthetic food additives are not extracts, but are as a result of chemical or enzymatic reaction. <p>Similarities</p> <ul style="list-style-type: none"> ✓ Both generally make food delicious/preserve foods/harmful when consumed in excess etc.

Item 7

Raw materials	<p>Sulphur, Water, Vanadium(V) oxide</p>
Processing of sulphuric acid production	<ul style="list-style-type: none"> ✓ The sulphur is roasted in air to form sulphur dioxide in a furnace/sulphur burner. $S(s) + O_2(g) \longrightarrow SO_2(g)$ ✓ The sulphur dioxide formed is mixed with excess air, purified in a purifier, compressed and passed over finely divided vanadium(V) oxide at 400-500°C and 1-2 atmospheres in a catalytic chamber/converter. The gases react to form sulphur trioxide. $2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$ ✓ The sulphur trioxide formed is absorbed in concentrated sulphuric acid in an absorption chamber to form oleum which is then diluted with an appropriate amount of water in the dilutor to form sulphuric acid of a desired concentration. $SO_3(g) + H_2SO_4(l) \longrightarrow H_2S_2O_7(l)$ ✓ The sulphuric acid is then stored in the storage tanks.

Effects of the mining and plant on the environment

- Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lower of soil pH/low crop production/soil productivity etc. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machines to neutralize the acidic gases/fumes, fitting catalytic converters to convert oxides of nitrogen to nitrogen e.t.c
- Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results death of insects and other animals due suffocation. Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses. This can be mitigated by enforcing strict laws to protect the community/regular maintenance and monitoring (inspection) of the equipment/reduction, recycle and re-use of wastes like plastics.
- Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in the atmosphere and hence, global warming/increase famine etc. This can be mitigated planting of trees that grow and mature so fast.
- Global warming due to emissions of gases like carbon dioxide, steam, methane, nitrous oxide etc. This result into change in rainfall pattern. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels.

Social benefits

- Employment opportunity; improved income thus better standards of living.
- Development of infrastructure e.g. roads which facilitate trade, improved income thus better standards of living.
- Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better a healthy community.
- Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

Item 8

Raw material	<ul style="list-style-type: none"> • copper pyrites • water • frothing agent • silica/sand • limestone • air
Process of copper	<ul style="list-style-type: none"> ✓ The ore is crushed and mixed with water containing a frothing agent (e.g. oil and other chemicals) in large metallic tanks. The mixture is

<p>production</p>	<p>agitated by blowing in air. This helps to separate the ore from earthy impurities. The ore is carried to the top in froth and impurities sink to the bottom.</p> <ul style="list-style-type: none"> ✓ The froth is filtered off and acid added to break it. The mixture is filtered off to obtain a concentrated ore. ✓ The concentrated ore is roasted in air to produce copper(I) sulphide, sulphur dioxide and iron(II) oxide. <p>Equation for the roasting the concentrated ore is:</p> $2\text{CuFeS}_2(s) + 4\text{O}_2(g) \longrightarrow \text{Cu}_2\text{S}(s) + 2\text{FeO}(s) + 3\text{SO}_2(g)$ <ul style="list-style-type: none"> ✓ The roasted product is mixed with silicon dioxide (sand) and limestone and heated in the absence of air in a furnace. This helps to convert solid iron(II) oxide which is an impurity into molten slag which is poured off to leave behind copper(I) sulphide. <p>The equation involved is:</p> $\text{FeO}(s) + \text{SiO}_2(s) \longrightarrow \text{FeSiO}_3(l)$ <ul style="list-style-type: none"> ✓ The copper(I) sulphide is reduced to impure blister copper by heating it in a regulated supply of air (oxygen). <p>The equation involved is:</p> $\text{Cu}_2\text{S}(s) + \text{O}_2(g) \longrightarrow 2\text{Cu}(s) + \text{SO}_2(g)$ <ul style="list-style-type: none"> ✓ The impure copper (blister copper) formed is purified/refined by electrolysis as follows: <p>The electrolytic cell is made up of impure copper/blister copper as the anode and pure copper serves as the cathode. The electrolyte is acidified copper(II) sulphate solution.</p> <p>During electrolysis:</p> <p>At the anode, pure copper dissolves to form copper(II) ions. Impurities are left behind.</p> <p>Equation is: $\text{Cu}(s) \longrightarrow \text{Cu}^{2+}(aq) + 2e^-$</p> <p>At the cathode, pure copper is deposited.</p> <p>Equation is: $\text{Cu}^{2+}(aq) + 2e^- \longrightarrow \text{Cu}(s)$</p>
<p>Negative effects of the copper plant on the environment</p>	<ul style="list-style-type: none"> • Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lowering of soil pH/low crop production/soil productivity etc. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machines to neutralize the acidic gases/fumes, fitting catalytic converters to convert oxides of nitrogen to nitrogen etc. • Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results, death of insects and other animals due to suffocation. Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses.

	<p>This can be mitigated by enforcing strict laws to protect the community/regular maintenance and monitoring (inspection) of the equipment/reduction, recycle and re-use of wastes like plastics.</p> <ul style="list-style-type: none"> • Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in the atmosphere and hence, global warming/increased famine etc. This can be mitigated planting of trees that grow and mature so fast. • Global warming due to emissions of gases like carbon dioxide, steam, methane, nitrous oxide etc. This result into change in rainfall patterns. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels.
Social benefits	<ul style="list-style-type: none"> • Employment opportunity; improved income thus better standards of living. • Development of infrastructure e.g. roads which facilitates trade. • Improved income thus better standards of living. • Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better healthy community. • Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

Item 9

Category and Reason and Example	<p>Natural resources are either renewable or non-renewable</p> <p>Renewable resource; cannot be used up or exhausted/when used up can be replaced easily/can be replenished e.g. air, water, wind, solar etc.</p> <p>Non-renewable; can be used up or exhausted/when used up cannot be replaced easily/cannot be replenished e.g. rocks, minerals</p>
Composition of the natural resources	<ul style="list-style-type: none"> ✓ Water; compound of hydrogen and oxygen ✓ Forests; are made of trees with elements like carbon, hydrogen and oxygen ✓ Air; mixture of oxygen, nitrogen, carbon dioxide etc ✓ Rocks; minerals like calcium carbonate, aluminium, iron etc
Impact of activities on natural resources; how it occurs and mitigation	<ul style="list-style-type: none"> • Crop husbandry; fertilizers and manure are used which pollutes water bodies and make them unsafe for use. This can be mitigated by sensitize farmers to use controlled doses of fertilizers and manure in gardens/use organic fertilizers • Crop/animal husbandry; trees and other vegetation are cut down to create space; water cycle is disrupted-hence, less rainfall is received. This can be mitigated by planting trees that grow and mature fast.

	<ul style="list-style-type: none"> • Crop/animal husbandry: trees and other vegetation are cut down to create space; carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast. • Stone quarrying involves breaking rocks for other uses like building. This leads to water contamination by quarry residues washed down by erosion to the stream and rivers/disrupts underground water cycle/water table will be lowered and hence, wells will dry up. Also, air pollution by dust. This can be mitigated by land reclamation of quarried areas/land refilling of quarried areas/putting in strict laws against stone quarrying. • Charcoal burning; trees are cut down and burnt to form charcoal; carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast/using alternative fuel sources like charcoal briquettes or biogas. • Mills emitted greenhouse gases as result of burning carbon/fossil fuels. This results into global temperature rise. This can be mitigated by using alternative fuel sources wind and solar power/planting trees that grow and mature so fast. • Mills release toxic wastes and other wastes like plastics which are thrown into landfills. These reduce soil productivity hence some crops will die dry out. The wastes may also be washed to the different water sources and this the water not safe for use by living organisms. This can be mitigated by putting in strict laws against the disposal of the wastes/ensuring proper waste disposal
Benefit/ Importance of natural resources to everyday life (mentioned benefit and explained)	<ul style="list-style-type: none"> • Air is used for respiration: food is broken down to release energy for proper body functioning. • Air facilitates photosynthesis: carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to make glucose and oxygen. • Water bodies help in rain formation: liquid water is converted into water vapour using energy from the sun which rises to the sky and later cooled into clouds- which then returns as rainfall. • Water bodies provide water for irrigation: this helps to cool crops and makes them to grow healthy and hence, boost food production. • Water bodies provide water for drinking: this helps to cool our bodies and dissolve the food we eat, and get rid of the wastes through urination. • Generate HEP: fast moving waters drive the turbines; and turbines mechanical energy is converted into electricity.

	<ul style="list-style-type: none"> • Forests/trees provide us with oxygen: during photosynthesis oxygen is released and can be used during respiration. • Forests/trees reduce greenhouse effect: since they use carbon dioxide during photosynthesis and oxygen which can be used during respiration is released. • Trees from the forests are used as fuel: since they burn to release heat energy which can be used for cooking etc.
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Item 10

Category and Reason and Example	<p>Natural resources are either renewable or non-renewable.</p> <p>Renewable resource: cannot be used up or exhausted/when used can be replaced easily/can be replenished e.g. air, water, wind, solar etc.</p> <p>Non-renewable: can be used up or exhausted/when used up cannot be replaced easily/cannot be replenished e.g. rocks, minerals, coal etc.</p>
Composition of the natural resources	<ul style="list-style-type: none"> ✓ Water: compound of hydrogen and oxygen ✓ Sand is made up of silica/quartz, calcium carbonate, gypsum, magnetite/haematite etc. ✓ Forests: are made of trees with elements like carbon, hydrogen and oxygen ✓ Air: mixture of oxygen, nitrogen, carbon dioxide etc ✓ Rocks: minerals like calcium carbonate, aluminium, iron etc
Impact of activities on natural resources; how it occurs and mitigation	<ul style="list-style-type: none"> • Crop husbandry: fertilizers and manure are used which pollutes water bodies and make them unsafe for use. This can be mitigated by sensitizing farmers to use controlled doses of fertilizers and manure in gardens/use organic fertilizers. • Crop/animal husbandry: trees and other vegetation are cut down to create space; water cycle is disrupted-hence, less rainfall is received. This can be mitigated by planting trees that grow and mature fast. • Crop/animal husbandry: trees and other vegetation are cut down to create space; carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast. • Brick making involves clearing the swamps/vegetation to create space and cutting down trees to burn the bricks; this causes destruction of vegetation, soil degradation and decrease in ground water levels. This can be mitigated by planting trees that grow and

	<p>mature fast/pit refilling/strict laws against brick making/using modern and less harmful methods etc.</p> <ul style="list-style-type: none"> • During the burning of bricks, a lot of carbon dioxide and black carbon are released into the atmosphere; accumulation of the two substances cause climate change and hence rapid changes in the patterns of rainfall and cloud formation. This can be mitigated by planting trees that grow and mature fast/pit refilling/strict laws against brick making/using modern and less harmful methods etc. • Sand mining involves extraction of sand by use of sand pit/open pit for other uses; this results into contamination of local streams and wet lands/salination of aquifers/disruption of the ground water levels. This can be mitigated by land reclamation of quarried areas/land refilling of quarried areas/putting in strict laws against sand mining.
Benefit/ Importance of natural resources to everyday life (mentioned benefit and explained)	<ul style="list-style-type: none"> • Air is used for respiration; food is broken down to release energy for proper body functioning. • Air facilitates photosynthesis; carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to make glucose and oxygen. • Water bodies help in rain formation; liquid water is converted into water vapour using energy from the sun which rises to the sky and later cooled into clouds- which then returns as rainfall. • Water bodies provide water for irrigation; this helps to cool crops and makes them to grow healthy and hence, boost food production. • Water bodies provide water for drinking; this helps to cool our bodies and dissolve the food we eat, and get rid of the wastes through urination. • Forests/trees provide us with oxygen; during photosynthesis oxygen is released and can be used during respiration. • Forests/trees reduce greenhouse effect; since they use carbon dioxide during photosynthesis and oxygen which can be used during respiration is released. • Sand is used for construction of houses; sand is mixed with cement and applied to firmly bind bricks together.

Item 11

Raw material	<ul style="list-style-type: none"> • Brine • graphite • mercury
Process of sodium hydroxide	✓ Brine is electrolyzed in an electrolytic cell having graphite anode and mercury cathode.

<p>roduction</p>	<ul style="list-style-type: none"> ✓ During the process, chloride and hydroxide ions migrate to the anode. Chloride ions are preferentially discharged by electron loss to form chlorine gas. This is due to its high concentration. $Cl^-(aq) \rightarrow e^- + Cl_2(g)$ The chlorine formed is dried, liquefied and stored in tightly closed tanks. ✓ Sodium and hydrogen ions move to the cathode. Due to its high concentration, sodium ions are discharge in preference to hydrogen ions by electron gain to form sodium metal. ✓ The sodium metal dissolves (or combines with) in mercury to form sodium amalgam which is reacted (or dissolved in) with water to form sodium hydroxide solution, hydrogen and mercury. Mercury is fed back into the cell for re-use as the cathode. Equations are: $Na^+(aq) + e^- \rightarrow Na(s)$ $Na(s) + Hg(l) \rightarrow \underset{\text{sodium amalgam}}{Na/Hg(l)}$ $2Na/Hg(l) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g) + 2Hg(l)$ ✓ The sodium hydroxide solution is evaporated to dryness to molten sodium hydroxide and cooled form solid sodium hydroxide.
<p>gative effects sodium droxide plant the ironment</p>	<ul style="list-style-type: none"> • Mercury poisoning. Exposure to inhalation of mercury can result into damage to the nervous system, kidneys, liver and immune system. This may result into cancer and hence death. This can be mitigated by posting hazard and warning information in the working area/communicating all information on the health and safety hazards of mercury to potentially exposed persons. • Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lowering of soil pH/low crop production/soil productivity etc. This can mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machines to neutralize the acidic gases/fumes, fitting catalytic converters to convert oxides of nitrogen to nitrogen e.t.c • Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results, death of insects and other animals due suffocation. Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses. This can be mitigated by enforcing strict laws to protect the community/regular maintainece and monitoring (inspection) of the

	<p>equipment/reduction, recycle and re-use of wastes like plastics.</p> <ul style="list-style-type: none"> • Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in the atmosphere and hence, global warming/increased famine etc. This can be mitigated planting of trees that grow and mature so fast. • Global warming due to emissions of gases like carbon dioxide, steam, methane, nitrous oxide etc. This result into change in rainfall patterns. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels.
Social benefits	<ul style="list-style-type: none"> • Employment opportunity; improved income thus better standards of living. • Development of infrastructure e.g. roads which facilitate trade, improved income thus better standards of living. • Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better a healthy community. • Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

Item 12

Raw material	<p>Either haematite, coke, limestone and air Or magnetite, coke, limestone and air Or siderite/spathic iron ore/iron(II) carbonate, coke, limestone and air</p>
Process of iron production	<p>The processes involved:</p> <ol style="list-style-type: none"> 1. The ore is first roasted in air to drive off water. 2. The roasted product is mixed with coke and limestone, powdered and dropped into the furnace from the top. 3. Hot air at 800°C is blown into the furnace from the bottom via tuyeres. 4. The hot air burns coke to form carbon dioxide and heat. $\text{Carbon} + \text{oxygen} \rightarrow \text{carbon dioxide}$ The carbon dioxide is reduced by hot unburnt coke as it raises up the furnace to form carbon monoxide. $\text{Carbon dioxide} + \text{coke} \rightarrow \text{carbon monoxide}$ 5. The carbon monoxide formed reduces the oxide of iron to molten iron which falls to the bottom of the furnace. Carbon dioxide is also formed. The molten iron is called pig/cast iron. $\text{Iron(III) oxide} + \text{carbon monoxide} \rightarrow \text{Iron} + \text{carbon dioxide}$ 6. The limestone decomposes to form calcium oxide and carbon dioxide. The calcium oxide combines with sand/silica present as an impurity in the ore to form molten slag of calcium silicate. $\text{Calcium carbonate} \rightarrow \text{calcium oxide} + \text{carbon dioxide}$ $\text{Calcium oxide} + \text{silica} \rightarrow \text{calcium silicate}$

	<p>Calcium oxide + alumina \rightarrow calcium aluminate</p> <p>7. The slag falls to the bottom and protects the iron from being re-oxidised by hot air.</p> <p>Both iron and slag are tapped differently and allowed to cool.</p>
ively,	<p>The processes involved:</p> <p>8. Iron(II) carbonate is roasted in air to form iron(III) oxide and carbon dioxide.</p> <p>Iron(II) carbonate + oxygen \rightarrow iron(III) oxide + carbon dioxide</p> <p>9. The roasted product is mixed with coke and limestone. The mixture is powdered and dropped into the furnace from the top. Hot air at 800°C is blown into the furnace from the bottom via tuyeres.</p> <p>10. The hot air burns coke to form carbon dioxide and heat.</p> <p>Carbon + oxygen \rightarrow carbon dioxide</p> <p>The carbon dioxide is reduced by hot unburnt coke as it raises up the furnace to form carbon monoxide.</p> <p>Carbon dioxide + carbon \rightarrow carbon monoxide</p> <p>11. The carbon monoxide formed reduces the oxide of iron to molten iron which falls to the bottom of the furnace. Carbon dioxide is also formed.</p> <p>The molten iron is called pig/cast iron.</p> <p>Iron(III) oxide + carbon monoxide \rightarrow iron + carbon dioxide</p> <p>12. The limestone decomposes to form calcium oxide and carbon dioxide. The calcium oxide combines with sand/silica present as an impurity in the ore to form molten slag of calcium silicate.</p> <p>Calcium carbonate \rightarrow calcium oxide + carbon dioxide</p> <p>Calcium oxide + silica \rightarrow calcium silicate</p> <p>Calcium oxide + alumina \rightarrow calcium aluminate</p> <p>13. The slag falls to the bottom and protects the iron from being re-oxidised by hot air.</p> <p>Both iron and slag are tapped differently and allowed to cool.</p>
e effects	<ul style="list-style-type: none"> • Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lowering of soil pH/low crop production/soil productivity etc. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machines to neutralize the acidic gases/fumes, fitting catalytic converters to convert oxides of nitrogen to nitrogen etc.
ion plant	<ul style="list-style-type: none"> • Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results, death of insects and other animals due to suffocation.
nent	<p>Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses.</p> <p>This can be mitigated by enforcing strict laws to protect the</p>

	<p>community/regular maintenance and monitoring (inspection) of the equipment/reduction, recycle and re-use of wastes like plastics.</p> <ul style="list-style-type: none"> • Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in the atmosphere and hence, global warming/increased famine etc. This can be mitigated by planting of trees that grow and mature so fast. • Global warming due to emissions of gases like carbon dioxide, steam, methane, nitrous oxide etc. This results into change in rainfall patterns. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels.
Social benefits	<ul style="list-style-type: none"> • Employment opportunity: improved income thus better standards of living. • Development of infrastructure e.g. roads which facilitate trade, improved income thus better standards of living. • Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better a healthy community. • Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

Item 13

Category and Reason and Example	<p>Natural resources are either renewable or non-renewable</p> <p>Renewable resource: cannot be used up or exhausted/when used up can be replaced easily/can be replenished e.g. air, water, wind, solar etc.</p> <p>Non-renewable; can be used up or exhausted/when used up cannot be replaced easily/cannot be replenished e.g. rocks, minerals</p>
Composition of the natural resources	<ul style="list-style-type: none"> ✓ Water: compound of hydrogen and oxygen ✓ Forests: are made of trees with elements like carbon, hydrogen and oxygen ✓ Air: mixture of oxygen, nitrogen, carbon dioxide etc ✓ Rocks: minerals like calcium carbonate, aluminium, iron etc
Impact of activities on natural resources; how it occurs and mitigation	<ul style="list-style-type: none"> • Crop husbandry: fertilizers and manure are used which pollutes water bodies and make them unsafe for use. This can be mitigated by sensitizing farmers to use controlled doses of fertilizers and manure in gardens/use organic fertilizers. • Crop/animal husbandry: trees and other vegetation are cut down to create space: water cycle is disrupted-hence, less rainfall is received. This can be mitigated by planting trees that grow and mature fast.

	<ul style="list-style-type: none"> • Crop/animal husbandry; trees and other vegetation are cut down to create space; carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast. • Stone quarrying involves breaking rocks for other uses like building. This leads to water contamination by quarry residues washed down by erosion to the stream and rivers/disrupts underground water cycle/water table will be lowered and hence, wells will dry up. Also, air pollution by dust. This can be mitigated by land reclamation of quarried areas/land refilling of quarried areas/putting in strict laws against stone quarrying. • Charcoal burning; trees are cut down and burnt to form charcoal carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast/using alternative fuel sources like charcoal briquettes or biogas. • Mills emitted greenhouse gases as result of burning carbon/fossil fuels. This results into global temperature rise. This can be mitigated by using alternative fuel sources wind and solar power/planting trees that grow and mature so fast. • Mills release toxic wastes and other wastes like plastics which are thrown into landfills. These reduce soil productivity hence some crops will die dry out. The wastes may also be washed to the different water sources and this the water not safe for use by living organisms. This can be mitigated by putting in strict laws against the disposal of the wastes/ensuring proper waste disposal.
Benefit/ Importance of natural resources to everyday life (mentioned benefit and explained)	<ul style="list-style-type: none"> • Air is used for respiration; food is broken down to release energy for proper body functioning. • Air facilitates photosynthesis; carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to make glucose and oxygen. • Water bodies help in rain formation; liquid water is converted into water vapour using energy from the sun which rises to the sky and later cooled into clouds- which then returns as rainfall. • Water bodies provide water for irrigation; this helps to cool crops and makes them to grow healthy and hence, boost food production. • Water bodies provide water for drinking; this helps to cool our bodies and dissolve the food we eat, and get rid of the wastes.

	<p>through urination.</p> <ul style="list-style-type: none"> • Generate HEP: fast moving waters drive the turbines; and turbines mechanical energy is converted into electricity. • Forests/trees provide us with oxygen: during photosynthesis oxygen is released and can be used during respiration. • Forests/trees reduce greenhouse effect: since they use carbon dioxide during photosynthesis and oxygen which can be used during respiration is released. • Trees from the forests are used as fuel; since they burn to release heat energy which can be used for cooking etc.
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Item 14

Raw material	<p>Oil or fat (lipids/glyceride)</p> <p>Sodium (potassium) hydroxide solution</p> <p>Brine (concentrated sodium chloride solution)</p> <p>Water</p>
Process of soap production	<ul style="list-style-type: none"> ✓ Oil (or fat) is boiled/heated with concentrated sodium/potassium hydroxide solution (caustic soda/potash) with constant stirring in a large metallic tank until frothing stops/for some time/until no further change. ✓ Brine is added to the mixture to precipitate soap. ✓ The mixture is stirred and allowed to cool. ✓ Solid soap is filtered off, washed and dried. ✓ The soap is further purified by boiling it in water and re-precipitating the soap with brine.
Negative effects of soap plant on the environment	<ul style="list-style-type: none"> • Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lowering of soil pH/low crop production/soil productivity etc. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machines to neutralize the acidic gases/fumes, fitting catalytic converters to convert oxides of nitrogen to nitrogen etc. • Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results, death of insects and other animals due to suffocation. Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses. This can be mitigated by enforcing strict laws to protect the community/regular maintenance and monitoring (inspection) of the equipment/reduction, recycle and re-use of wastes like plastics.

	<ul style="list-style-type: none"> • Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in the atmosphere and hence, global warming/increased famine etc. This can be mitigated planting of trees that grow and mature so fast. • Global warming due to emissions of gases like carbon dioxide, steam, methane, nitrous oxide etc. This result into change in rainfall patterns. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels. • Prolonged exposure to alkalis which are harmful can result into blindness, skin/throat/nose irritation, chemical burns, breathing difficulties etc. This may result into cancer and hence death. This can be mitigated by posting hazard and warning information in the working area/communicating all information on the health and safety hazards of alkalis to potentially exposed persons.
cial benefits	<ul style="list-style-type: none"> • Employment opportunity; improved income thus better standards of living. • Development of infrastructure e.g. roads which facilitate trade, improved income thus better standards of living. • Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better a healthy community. • Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

tem 16

category and reason and example	<p>Natural resources are either renewable or non-renewable</p> <p>Renewable resource: cannot be used up or exhausted/when used up can be replaced easily/can be replenished e.g. air, water, wind, solar etc.</p> <p>Non-renewable: can be used up or exhausted/when used up cannot be replaced easily/cannot be replenished e.g. rocks, minerals, sand etc.</p>
composition of the natural resources	<ul style="list-style-type: none"> ✓ Water: compound of hydrogen and oxygen ✓ Sand is made up of silica/quartz, calcium carbonate, gypsum, magnetite/haematite etc. ✓ Forests: are made of trees with elements like carbon, hydrogen and oxygen ✓ Air: mixture of oxygen, nitrogen, carbon dioxide etc ✓ Rocks: minerals like calcium carbonate, aluminium, iron etc
impact of activities on	<ul style="list-style-type: none"> • Crop husbandry: fertilizers and manure are used which pollutes water bodies and make them unsafe for use. This can be mitigated

natural resources - how it occurs and mitigation

by sensitize framers to use controlled doses of fertilizers and manure in gardens/use organic fertilizers.

- Crop/animal husbandry: trees and other vegetation are cut down to create space; water cycle is disrupted-hence, less rainfall is received. This can be mitigated by planting trees that grow and mature fast.
- Crop/animal husbandry: trees and other vegetation are cut down to create space; carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast.
- Brick making involves clearing the swamps/vegetation to create space and cutting down trees to burn the bricks; this causes destruction of vegetation, soil degradation and decrease in ground water levels. This can be mitigated by planting trees that grow and mature fast/pit refilling/strict laws against brick making/using modern and less harmful methods etc.
- During the burning of bricks, a lot of carbon dioxide and black carbon are released into the atmosphere; accumulation of the two substances cause climate change and hence rapid changes in the patterns of rainfall and cloud formation. This can be mitigated by planting trees that grow and mature fast/pit refilling/strict laws against brick making/using modern and less harmful methods etc.
- Sand mining involves extraction of sand by use of sand pit/open pit for other uses; this results into contamination of local streams and wet lands/salination of aquifers/disruption of the ground water levels. This can be mitigated by land reclamation of quarried areas/land refilling of quarried areas/putting in strict laws against sand mining.

Benefit/Importance of natural resources to everyday life (mentioned benefit and explained)

- Air is used for respiration; food is broken down to release energy for proper body functioning.
- Air facilitates photosynthesis; carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to make glucose and oxygen.
- Water bodies help in rain formation; liquid water is converted into water vapour using energy from the sun which rises to the sky and later cooled into clouds- which then returns as rainfall.
- Water bodies provide water for irrigation; this helps to cool crops and makes them to grow healthy and hence, boost food production.
- Water bodies provide water for drinking; this helps to cool our bodies and dissolve the food we eat, and get rid of the wastes through urination.

- Forests/trees provide us with oxygen; during photosynthesis oxygen is released and can be used during respiration.
- Forests/trees reduce greenhouse effect; since they use carbon dioxide during photosynthesis and oxygen which can be used during respiration is released.
- Sand is used for construction of houses; sand is mixed with cement and applied to firmly bind bricks together.

Item 17 (Practical Item)

(a)	
Aim	To determine heat change for the reaction between iron and copper(II) sulphate solution $\sqrt{A} \sqrt{A}(02)$
Hypothesis	The reaction between iron and copper(II) sulphate solution produces a heat change above 5000J $\sqrt{H} \sqrt{H}(02)$
Variables	Independent variable
	Time $\sqrt{I}(01)$
	Dependent variable
	Temperature of the mixture $\sqrt{D}(01)$
	Controlled variable
	Volume of copper(II) sulphate kept constant $\sqrt{C}(01)$
Procedure with relevant materials	<ul style="list-style-type: none"> • Using a measuring cylinder, 25 cm³ of copper(II) sulphate solution was added into a plastic beaker or cup. • The initial temperature of the solution was measured using a thermometer. • All the iron powder provided was added at once to the solution in the beaker and at the same time a stop clock was started. • Temperature of the solution was recorded in the table below. $\sqrt{P} \sqrt{C} \sqrt{M}(03)$
Risk and mitigation	Care was taken to avoid inhaling any fumes produced by the reaction by wearing a mask. $\sqrt{R} \sqrt{S}(02)$

(b)

Presentation of data	Time(s)	0.0	30.0	60.0	90.0	120.0	150.0	180.0	210.0
	Temperature (°C)	27.0	35.0	38.0	38.0	37.5	37.0	36.5	36.0
Recording of data	$\sqrt{V} \sqrt{V} \sqrt{V} \sqrt{V} (04)$					$\sqrt{D} \sqrt{D} \sqrt{D} \sqrt{D} (04)$			
	Temperature values above 20								

(c)

Data analysis and interpretation	$\text{heat evolved} = (v \times d) \times SHC \times \Delta T$ $= 25 \times 1 \times 4.2 \times (39.5 - 27.0)$ $= 1312.5 \text{ J}$ $\sqrt[1]{\sqrt[1]{\sqrt[1]{(03)}}}$ <p>Values from a graph that is accurately plotted with all features</p>
Conclusion	<p>The reaction between iron and copper (II) ions cannot produce a significant amount of heat, ideally above 50,000 Joules for it to be used in making a food warmer.</p>