Item 3

Aluminium is a giant metallic substance it is made of very many metal ions in a sea of electrons held by metallic bonds.

Carbon dioxide is a simple molecular substance because it is made up of simple molecules formed by weak Vander Waal's forces (weak intermolecular forces).

Sand (Silicon dioxide) is a giant covalent substance because it contains many non-metal atoms joined by many extensive strong covalent bond.

Sodium chloride is a giant ionic substance because it consists of many oppositely charged ions held by strong electrostatic forces of attraction.

(b) Sodium Chloride

- Soluble in polar solvent like water
- They're crystalline solid at room tempt.
- They've high melting & boiling points.
- Conducts electricity in aqueous or molten state

Aluminium

- Conduct heat and Electricity
- They've high melting & boiling point
- light weight
- Sonorous, malleable, ductile, Ristant to corrosion.

CO_2

- Low melting & boiling point
- Denser than air
- Does not support burning.
- Slightly soluble in water
- Colorless gas at room tempt
- Solid CO_2 Sublimes.
- Odorless

Use

Use in fire extinguisher to put off fire since it does not support burning

Item 1

a) Laundry soap is a soapy detergent while the ultra clean X is a soapless detergent.

How it works

It works by lowering the surface tension btn water and the dirt and emulsification of the dirt. It has two parts i.e. the hydrophillic head that dissolves in water and hydrophobic tail that gets attached to the dirt. since it is fat soluble on constant agitation the dirt is removed from the fabric as tiny droplets or micelle which is poured/rinsed away.

(b) – The products can cause allergic reactions such as skin burns and blisters because they contain chemicals that interract with the skin tissue and corrode them. This can be mitigated by wearing protective gloves while using them.

– soap contains chemical ingridients that cause eye redness, irritation and intense pain if not treated immediately.

(C) Evaluating the products

. Similarities

– Both soapy & soapless detergents works by the same chemical mechanism of lowering the surface tension btn water & dirt.

– Both have the hydrophilic and hydrophobic parts.

– Both are effective cleansing agents with soft water

Differences:

– Soapy detergents forms scum with hard water while soapless detergent donot form scum with hard water.

– soapy detergent is biodegradable while soapless detergent are non-biodegradable.

– Soapy detergent are not effective in strong acidic medium while soapless detergent is effective in strong acidic mediums.

Item 2

(a) i) Aluminium and iron are metals because they lose their outermost / valency electrons to gain stability.

(ii) Suitability

Aluminium

- It is a good conductor of heat & Electricity
- It strong, sonorous, high melting and Boiling point, Resistant to corrosion, shining appearance, Malleable and Ductile.

Atleast 4P + 1Use

(iii) Use

- Aluminium is used for making packaging materials eg aluminum foil..
- Making Door / window frames
- Making aircraft bodies / bicycle parts

(iv) Environmental Risks & Mitigations

Aluminium is non-biodegradable hence when poorly disposed into the soil leads to soil pollution/infertility reducing crop yields. This can be mitigated by recycling of the aluminium / Proper disposal of aluminium material.

Continuation of item 3

SiO_2

- High melting and Boiling point
- poor Conductor Electricity
- Insoluble in water
- Hard Crystaline Solid
- High density.

Use in construction bise it is hard hence makes a strong Motar

Graphite

- Good conductor of Electricity
- Soft and Slippery
- Black and opaque
- Density of $2.26 g cm^{-3}$

Use

Making battery Electrodes since it is a good Conductor

4P + 1use

(d) Environmental impact + mitigation

Sodium chloride

Accumulation of sodium chloride in water bodies increases the osmotic potential of water causing some aquatic organism to lose water thus leading to death. This can be mitigated by desalination.

(a) Item 4

Element	C	H	O
mass composition	2.4	0.6	1.6 ✓
Atomic mass	12	1	16
moles	$\frac{2.4}{12}$	$\frac{0.6}{1}$	$\frac{1.6}{16}$ ✓
	0.2	0.6	0.1
mole ratio	$\frac{0.2}{0.1}$	$\frac{0.6}{0.1}$	$\frac{0.1}{0.1}$ ✓
	2	6	1 ✓

Empirical formula is C_2H_6O ✓

Molecular formula;

$(Ef)_n$ = molecular mass

$(C_2H_6O)_n = 46$ ✓

$((2\times12)+6+16)_n = 46$ ✓

$(24+6+16)n = 46$

$\frac{46n}{46} = \frac{46}{46}$

$n = 1$ ✓

(6–4)w = 04

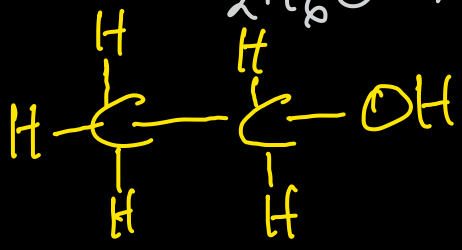
(3–5)w = 02

& below = 00

Molecular formula $= (C_2H_6O)_1$

∴ Molecular formular is C_2H_6O ✓

Structural formula



OR

CH_3CH_2OH

General formula for alcohol is $C_nH_{2n+1}OH$

Substitute for $n=2$ in G.F C_2H_5OH

(b) The substance is alcohol ✓C because it has a functional group $-OH$ ✓R

(c) - It is Highly flammable
- It is a Volatile Liquid
- It is a Colorless Liquid at room temperature
- It has a low melting and boiling point
- It is soluble in water.

Other use

- used Six's thermometer to determine very low temperature.
- Sterilizing Medical equipments.
- Deodorant

4P + 1U = 5F

(1-2)P + 14 = 02

(3-4)P + 04 = 00

(e) Highly flammable and can leads to fire outbreak which can destroy properties. This can be mitigated by proper storage or keeping it away from fire.

Item 5

(a) $2Ca_{(s)} + O_{2(g)} \longrightarrow 2CaO_{(s)}$

↑ Element burnt

C ✓ R ✓

Calcium is a metal because it loses it's outermost Velency electron to gain Stability.

Properties

- Has High melting & boiling point
- Conduct electricity
- Highly reactive with water and Acids.
- Malleable ie Can be rolled into thin sheets without breaking.
- Ductile i.e. Can be drawn into thin wires.

Calcium is an essential element which is required for the formation of strong bone and teeth.

(b)

$2Ca_{(s)} + O_{2(g)} \longrightarrow 2CaO_{(s)}$

0.3g 8 0.42

Element	Ca	O
Mass composition	0.3	(0.42 − 0.3)
Mole	0.3/40	0.12/16
	0.0075	0.0075
Mole ratio	0.0075/0.0075	0.0075/0.0075
	1	1

Empirical formula is CaO

Molecular formula $(CaO)_n = 56$

$(40+16)_n = 56$

$\frac{56n}{56} = \frac{56}{56}$

$n = 1$

Molecular formula is CaO

c) Environmetal impact & mitigation

Production of Quicklime requires the use of fossil fuel like coal which when burnt as energy source in the production of lime emit large amount of $CO_{2(g)}$ leading to global warming. This can be mitigated by planting fast growing trees

Item 6

a)

Element	C	H
Mass composition (g)	8.6	(10 − 8.6)
Moles	$\frac{8.6}{12}$	$\frac{1.4}{1}$
	0.717	1.4
mole ratio	$\frac{0.717}{0.717}$	$\frac{1.4}{0.717}$
	1	1.953
	!	2
Empirical formula	CH_2	

$(CH_2)_n = 28$

$(12+2)n = 28$

$\frac{14n}{14} = \frac{28}{14}$

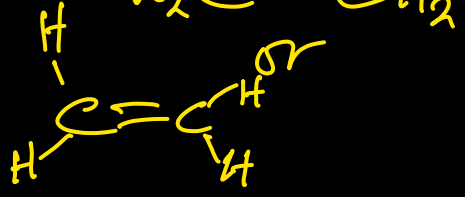
$n = 2$

Molecular formula $= (CH_2)_2$

$= C_2H_4$

Structural formula

$H_2C=CH_2$



(b) Q is an alkene since it has C=C double bond OR

Q is an alkene since it conforms to the general formula C_nH_{2n} OR Q is an hydrocarbon because it contain carbon and hydrogen atoms only.

(c)

(i) Z is polyethene

Properties

- water proof
- poor conductor of heat & electricity
- Light in weight
- Non-biodegradable
- Can be remoulded when heated
- Resistant to Corrosion.

(ii) Use: Making Packaging material

(d) The complex molecule Z is non-biodegradable and this can pollute the environment since it present air & water from penetrating in the soil. This can be Mitigated by Recycling / Proper disposal

Item 6

Rfm of $CaI_2 = 40 + (2 \times 36) = 112$ ✓

Rfm of $NaI = 23 + 36 = 59$ ✓

2 mole of NaI produce 1 mole of CaI_2

(2×59)g of NaI produce (1×112)g of CaI_2 ✓

100,000g of NaI produce $\left(\frac{112 \times 100{,}000}{2 \times 59}\right)$g of CaI_2 ✓

$$\text{Mole} = \frac{\text{mass}}{\text{Rfm}}$$

$= 94915.25$g of CaI_2 ✓

$\simeq 94.9151$Kg of CaI_2 ✓

b) Water demineralized of Ca is soft water

- It does not waste soap during washing.
- It forms Lather easily with soap during washing

c) - It can be used as manure in farm land to improve on the crop yield.

- It can also be used as feeds for chicken & Pigs.

d) It increases the pH of the soil which makes the soil alkaline hence affecting soil fertility however this can be mitigated by proper disposal of Calcium Zeolite.