Chemistry marking guide set 4.

CHEMISTRY GUIDE SET 4

ITEM I

A Radiations. These are ionising radiators such as x-rays, alpha particles beta particles and gamma rays.
Non-ionising radiators like television and radio waves.

B X rays have high penetrating energy and is used in medical facilities for screening foetus in expectant mothers and scanning cancers. Whereas the energy in television and radio waves is not very powerful so does not cause ionisation of atom or body cells unlike the x-rays

C Ionising radiations are very powerful radiations that cause ionisation of body cells hence harmful as their effect can cause cancers.

Non-ionising radiations are safe

Mitigation

- put on protective gear like lead coats
- Avoid exposure to radioactive materials or such ionising radiations
- Warning posters to alert people of the dangers of exposure to such radiations

D Ionising radiations and non-ionising radiations are both forms of nuclear energy.

Ionising radiation carry very powerful energy that knock out particles from the atom whereas non-ionising radiations dont knock out particles from atoms of elements

ITEM 2.

A A - is an atom of a metal magnesium because it has two electrons in its outermost energy level and in period 3

B is an atom of a non-metal oxygen because it has six electrons in the outermost energy level and in period 2.

B A has 12 electrons, 12 protons (P) and 12 neutrons (N) whereas structure B has eight electrons in the energy levels, 8 protons and 8 neutrons in the nucleus

properties

- protons are positively charged particles with a mass of approximately 1gram
They occur in the nucleus of the atom of an element

Neutrons are neutral particles found in the nucleus of an atom o the centre; have a mass of approximately 1gram

Electrons are negatively charged particles of an atom of an element; they occur in energy levels around the dense nucleus and ever revolving/rotating in their energy levels around the nucleus

- The atom has equal number of protons and electrons hence neutra

C A - is used to make bodies of air crafts

B - is for. respiration

b Magnesium is a heavy metal if consumed in food can cause cancer.

Mitigation Avoid consuming that accumulate heavy metals like yams.

ITEM 3

A The aluminium ores; banxite and cryolite

B Banxite is roasted in air to remove moisture and convert the iron(II) oxide to iron(III) oxide in it.

The roasted ore is crushed into a powder. mixed with hot concetrated sodium hydroxide solution.

The aluminium oxide dissolves in sodium hydroxide to form an aluminate

- $Al_2O_{3(s)} + 2OH_{(aq)} + 3H_2O_{(l)} \longrightarrow 2Al(OH)_{4(aq)}$

(or word equation / molecular equation)

Likewise silicon (IV) oxide which exists together with banxite as an impurity also dissolves to form sodium silicate.

$SiO_{2(s)} + 2OH_{(aq)} \longrightarrow SiO_3^{2-} + H_2O$

The other basic oxide impurities remain undissolved and are filtered away

carbondioxide is passed into the solution to precipitate out aluminium hydroxide which is filtered out, dried and heated to obtain pure aluminium oxide.

$2Al(OH)_4^- + CO_2 \rightarrow 2Al(OH)_{3(s)} + CO_{3(aq)}^{2-} + H_2O$

$2Al(OH)_{3(s)} \longrightarrow Al_2O_{3(s)} + 3H_2O_{(l)}$

The pure aluminium oxide is mixed with cryolite to lower its melting point and molten in a steel tank lined with carbon cathode; while the anode is also carbon

When molten aluminium oxide breaks down to aluminium and oxide ions

$Al_2O_{3(s)} \longrightarrow 2Al^{3+}_{(l)} + 3O^{2-}_{(l)}$

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The aluminium ions are discharged to aluminium at the carbon cathode by gain of electrons

$Al^{3+}_{(l)} + 3e \longrightarrow Al_{(l)}$

The molten aluminium is tapped off and allowed to solidify while at the graphite / carbon anode oxide ions are discharged to oxygen loss of electrons

$2O^{2-}_{(l)} - 4e \longrightarrow O_{2(g)}$

C Carbondioxide accumulation in the atmosphere from wearing of the carbon anode can contribute in global warming due to heat it traps and reflects back on earth.

Mitigation.

- Plant trees to reduce on the amount of carbondioxide in air by absorption in photosynthesis
- Acid rain formation which lowers oil PH; causes rocks like limestone to crumble and iron roofs to corrode.

Mitigation

- Install catalytic converters to remove the green house emissions into harmless products
- Burns from sodium hydroxide

Mitigation

PPE on protective wears.

D Industry offers opportunities for employment income generation and thus better living standards:

Improved road networks thus easy transport of materials to and from market, thus more profits and better life (or equivalent)

ITEM 4

A Brine

B Brine is electrolysed in an electrolytic cell using a mercury cathode and graphite anode

At the cathode sodium ions are discharged to sodium by gain of electrons

$Na^{+}_{(aq)} + e \longrightarrow Na_{(s)}$

while at the anode chloride by loss of electrons

$2Cl^{-}_{(aq)} - 2_{(l)} \longrightarrow Cl_{2(g)}$

The sodium at the cathode mixed with mercury to form an alloy of sodium amalgam which is dropped in water to manufacture sodium hydroxide

$2Na \cdot Hg + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + 2Hg_{(l)} + H_{2(g)}$

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The sodium hydroxide is separated out from mercury and used to make soap manufacture

C pollution by chlorine which being poisonous can kill organisms if inhaled in large quantities or dissolve in rainwater to cause acid rain

$Cl_{2(g)} + H_2O_{(l)} \longrightarrow HCl_{(aq)} + HOCl_{(aq)}$

The acid rain can corrode iron sheet roofs, crumble rocks or lower the soil PH

Mitigation

- Prevent release of chlorine into air by refrigeration
- convert chlorine into useful products such as ^to water treatment
- React chlorine with sodium to resynthesize sodium chloride

Burns caused by sodium on workers

Mitigation Wash with plenty of water then neutralise

Wear protective gear to prevent body contact with sodium.

D Job opportunities, population and families whose relatives are gainfully employed, earn income and improve on standards of living

Improved infrastructure, road network, school, hospitals thus better services and better standards of living

ITEM 5

A The natural resources affected are soils, air, water, trees, grass which are renewable natural resources because they can be replenished, are sustainable

The other types of natural resources is non renewable resources like fossil fuels, rocks and minerals because they get used up / exhausted with prolonged use and can not be replenished

B Air - consists of gases like oxygen, nitrogen, inut gases, carbondioxide, water vapour and pollutants

Water - Consists of the chemical elements hydrogen and oxygen
Natural water also has dissolved minerals, gases and living organisms which survive in it as their natural habitat

Soil - Has mineral elements, salt, air, water, living organisms

Vegetation / trees have tissues which contain the elements carbon, hydrogen, oxygen and others

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c Poor handling of natural resources impact negatively on the environment for example charcoal burning adds carbondioxide to air which causes global warming

High carbondioxide concetration also can cause acid rain which affects iron roofs of buildings

Charcoal burning also adds carbonmonoxide to air which is a respiratory poison

Mitigation for green house emissions

- Reafforestation so that vegetation planted reduces carbondioxide concetration in air

Mitigation for carbonmonoxide emission.

- Ensure enough air is introduced to convert the carbonmonoxide to the less dangerous carbondioxide

$$2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$$

Removal of trees affects/disturbs the water cycle by reducing chances of convectional rainfall because trees contribute to the water cycle through evapotranspiration that results in formation of raincloude and precipitation

Mitigation · Re-afforestation
put up laws restricting cutting of trees for charcoal burning or other activities without replacement

Restrict alcohol consumption to reduce the demand for firewood required to distill the local ethanol

This reduces on carbondioxide and carbonmonoxide emission into air

Cutting vegetation leaves soils bare and exposed to erosion

Mitigation
- plant cover crops
- plant trees

Soil contributes minerals for healthy plant growth which leads to food security

Brick making or making moulds for mud and wattle houses degrades soil, promotes erosion and results into soil infertility

Mitigation
- Prohibit brick burning
- use blocks made from stone dust cement and sand instead of burnt bricks or equivalents

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Air has oxygen which is used in respiration to burn sugars for energy release so that life processes can be sustained

Contains carbon dioxide that plants require for photosynthesis or equivalent

ITEM 6

A Water is a natural resource that is renewable because it can be replenished unlike fossil fuels which are non-renewable natural resource because the fuels like engine oil get exhausted and can not be replenished

B Water consists of the elements hydrogen and oxygen. It also has dissolved oxygen, carbondioxide, solutes, mineral salts and living organisms which survive in it as a habitat

C - Water is habitat to many organisms such as fish because it has oxygen, its neutral ~~dense~~ and can support life
- Water contributes to the water cycle through evaporation and precipitation
- It contributes convectional rainfall

Mitigation

- Do not ~~pour~~ pour oils in water as the oil reduces evaporation and denies escape of watervapour to the atmosphere hence reducing chances of rainfall
- Addition of chemicals such as oil reduces the amount of oxygen in water as the oil is immiscible with water, floats on water surface preventing oxygen from dissolving in it. This can lead to death of organisms like fish

Mitigation

- Do not release chemical wastes like oils in water
- Avoid the use of oil boats in fishing
- Clean off oil spills from the water

Sewage and human waste release into water makes water smelly, increases bacteria in the water polluting it. The water is unsafe for human use.
Even fish may be contaminated and lose market

Mitigation

Treat sewage before release into water

Detergents and some other chemical directly poured into the water may enrich water with fertilizers that algal growth/ algae blooms when algae dies and decay
it uses oxygen in water raising the biological oxygen demand hence death of other aquatic organisms like fish

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Mitigation

Penalise water polluters to discourage pollution

- Hot water release into the water body rises the temperature which may make fish to migrate to other areas of the lake

Mitigation

Discourage release of hot waters into the lake.

- use of undersize nets and chemicals in fishing result in catching immature fish or indiscriminate catching of fish which results in reduction in fish species

Mitigation

- Discourage use of undersize nets or bad fishing practices like using dangerous chemicals
- introduce heavy penalities to punish the offenders
- Restock the lake with young fish

D. - contributes to the formation of rainfall or water cycle

- is a habitat for many organisms like fish# from which government can earn income
- stabilises atmospheric temperatures by adding water vapour into air

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