CHEMICALS FOR CONSUMERS.

Competency: The leaner should be able to appreciate that the products used in everyday life exists as chemicals and some of them can be prepared at home.

Learning outcome.

The learner should be able to:

a) **analyse properties of soap and detergent and compare and contrast the effectiveness of their cleansing action (u, s)**
b) **evaluate the use of food additives (k, u, s)**
c) **understand the importance of chemicals in medicine (k, u)**
d) **appreciate the importance of the chemical industry and its contribution to our lives (u).**

Food additives.

These are ingredients which are added to food to improves its appearance, texture, taste, shelf life, freshness, thickness, bulkiness etc. they are found in many foods such as breads, baked goods, yoghurt, salad dressings, chips, and beverages.
Examples of food additives used are,

- Preservatives
- Food colour
- Thickeners
- Bulking agents
- Food enhancers
- Stabilisers
- Anti-oxidants.
- Sweeteners.

Importance of different food additives.

- **Preservatives.** To increase the shelf life of food by protecting them against deterioration caused by microorganism for example sodium benzoate which is used in beverages and other

foods to prevent spoilage, nitrates and nitrites, which is used in processed meats to inhibit bacteria, sulphites which are used to prevent discoloration and spoilage in dried fruits, fruit juices and wines and many others.

- **Food colour**. To change the appearance of food for example tetrazine, a common food dye used in many processed foods. Examples of natural food colors include beet juice (red), turmeric(yellow) blue berries, caramel, carmine etc. Synthetic food color includes tetrazine (yellow), amaranth (red), erythrosine etc.
- **Sweeteners.** used to change the taste of food and drinks. They can be natural or artificial. Examples of natural sweeteners include honey, maple syrup, sugar from carbohydrates for example glucose, sucrose and fructose whereas artificial sweeteners include aspartame, sucralose etc.
- **Flavor enhancers.** These are substances that intensify or modify flavors or aroma in food and drinks without adding flavors of their own. for example, monosodium glutamate (MSG) is used to intensify the flavor of savory dishes. It is often used in soups, sauces and processed foods. Other examples of flavoring agents include vanilla, lemon, lime, cherry, brandy, banana, butterscotch, citric acid. Honey, sugar alcohols, amines, aromatic oils, ketones, aldehydes etc. these add a particular aroma to food or drinks where they are added.
- **Stabilizers.** These are substances that help maintain the physical and chemical properties of materials, preventing degradation or changes in their desired state. Examples include hydrocolloids, these are long chain polysaccharides that increase the viscosity and prevent separation in liquids, xanthan, carrageenan and guar gum, which are used as stabilizers in ice cream to improve texture and prevent ice crystal growth, starch, etc.

  Stabilizers are classified into the following;
  - **Emulsifiers.** these are substances that help keep two immiscible liquids mixed such as oils and water in salad dressings. Examples include lecithin, a fatty substance in egg Yorks, soyabeans, and sunflowers, used in chocolate, margarine, and other foods to prevent oil and water from separating, honey, polysorbates etc.
  - **Thickeners**. these are substances that increase the viscosity of liquids, making them appear and feel thicker. Examples include roux, slurry, starch, proteins, gums etc.

thickeners work by interacting with the liquid or food they are added to, typically through hydration or creation of a gel structure. For example, starches swell and absorb water when heated, making the liquid thicker. Gums from a network of molecules that trap water increasing viscosity. Proteins can coagulate or from a gel structure when heated also thickening the substance.

- **Anti-oxidants.** These prevent or slow down the oxidation of materials protecting them from degradation. For examples blackberries, apples, nuts raspberries.

- **Bulking agents.** These are substances that increase the bulk or volume of food or other products often without adding a significant calories r nutrient for example yeast which causes the dough to rise in bakery.
- **Firming agents.** These are food additives that are added in order to precipitate residual pectin, thus strengthening the structure of the food and preventing its collapse during processing. They help preserve the structural and integrity of fruits, vegetables and other foods during processing and storage. Examples include calcium carbonate, calcium citrate, and calcium chloride among others.

The above food additives can be natural, **naturally occurring or existing on their own/created by God** or synthetic, **made by man from industries.** The food additives especially synthetic food additives contain chemicals that may be dangerous to the human body once one gets addicted to using them.

*Qn. Using internet, chemistry textbooks or any other source, research on examples of artificial food additives citing their specific use food additives. Your research should focus on the following**; sweeteners, preservatives**, **thickeners** and **flavor enhancers**.*

Dangers of long-term use of food additives.

- Increased chances of obesity, headache, decreased energy levels, induced breathing problems like asthma, weakened heart issue, causes cancer for example artificial preservatives.
- Learning disabilities, kidney damage, tumors, skin rashes, hyperkinesis, sleep disturbances caused by artificial flavoring agents.
- Hyperactivity or attention deficit in children especially over dependence on artificially colored drinks or foods.

- Allergic reactions.
- Digestive issues like diarrhoea, abdominal pain and bloating.

Medicine

Medicine is a substance such as pills or liquids used to treat illnesses or injuries. Medicine or drugs used in daily life are either manufactured from industries (modern) or obtained from plants and animals (traditional). Thus, medicine is either **modern / artificial; one made by man or traditional/ natural; one naturally existing.**

Examples of some traditional medicines and their roles.

- Phytolacca dodecandra.

✓ Its roots and leaves are pounded and smeared on a ripe banana which are then roasted and eaten.

✓ Helps in treatment of intestinal worms, ringworms, scabies.

✓ Is an excellent medicine for treatment of hard and painful swellings of glands including parotid gland, treating of anthrax, rabies and even as a contraceptive or abortion agent.

- Aloe vera.

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✓ Used for skin injuries such as burns, also used for digestive problems.

- Garlic.

✓ Helps in boosting immune system, lowering blood pressure and reducing cholesterol levels.

- Echinacea.

- Ginkgo.

- Used on common cold, ear infections, urinary tract, and skin wounds.
- Used for eye health, anxiety, premenstrual syndrome, schizophrenia, peripheral artery disease.

- Ginger.

- Help in digestion and treat stomach upset, diarrhoea and nausea.
- Reduce inflammations.

- Hawthorn.

- Works on low blood pressure, anxiety, kidney issues, heart disease, digestion.

- Passion flower.

- Works on sleep problems and anxiety

- Peppermint oil.

- Works on abdominal pain, indigestion, tension headache, irritable bowel syndrome.

- Valerian.

- ✓ Works on sleep problems, menopause symptoms and anxiety.

- Milk thistle.

  - ✓ Works on hepatitis and the two types of diabetes.
  - ✓ Improves liver function.
  - ✓ It may help prevent age-related decline in brain function.
  - ✓ It can lower blood sugar levels for people with diabetes.
- Licorice root.

  - ✓ Works on sore throat, digestive symptoms, among others.
- Guava leaf extracts.

  - ✓ Treats malaria, ulcers, cough and diarrhoea.
  - ✓ Reduce cancer risk because it contains powerful antioxidants that neutralize harmful free radicals.
  - ✓ Provides good eye sight because they are rich in vitamin A.
  - ✓ Good for weight loss.
  - ✓ Helps to reduce menstruation pain.

- Pawpaw leaf extract.

  - ✓ They are rich in anti-oxidants and vitamins C and E which boosts immune system and protection against infections and viruses.
  - ✓ It also supports digestion.
  - ✓ It can also help in regulating blood sugar.
  - ✓ It may also help in improving hair and skin health.

Side effects of the above traditional medicines.

- Echinacea may cause nausea and stomach pain.
- Oral supplements of garlic may increase the risk of bleeding, thus may be unsafe for people taking anticoagulants such as warfarin and those needing surgery.
- Ginkgo may cause headache, stomach upset, dizziness, constipation and skin reactions. May also cause the risk of bleeding.
- Ginger may cause abdominal discomfort, heartburn, diarrhoea and mouth and throat irritation particularly in large doses.
- Hawthorn may also cause dizziness, nausea, and digestive symptoms. May also interact in a harmful way with the heart medications.
- Passionflower may cause drowsiness, confusion and uncoordinated movements. Its un suitable for use during pregnancy as it may induce contractions.
- Milk thistle may cause digestive issues, allergic reactions.
- Peppermint oil may cause nausea, heartburn, abdominal pain and dry mouth. May also cause skin rashes and irritation is a person uses it topically.
- Valerian may cause headache, stomach upset, excitability, uneasiness and heart issues.

Medicines are classified into the following;

a. Analgesics for example Aspirin, paracetamol and codeine. They are also called pain killers. These contain chemicals that help to **reduce inflammations and relieve pain.** For example, Ibuprofen is used to reduce fever and to relieve aches and pain from headaches muscle aches, arthritis, menstrual periods, the common cold, toothache and backaches.

b. Antibiotics for example penicillin and streptomycin. **They are used in treatment of bacterial infections**. They work by disrupting or damaging the bacterial cell wall, preventing bacterial growth and spread. For example, penicillin is used in treatment of bacterial infections like strep throat, ear infections and urinary infections

c. Psychotherapeutic medicines such as stimulants, anti-depressants and antipsychotics.

   i. Stimulants are a class of drugs that increase the alertness. They are used to **enhance attention, motivation, cognition, mood and psychological performance. They can make a person feel more awake, alert, confident or energetic**. Examples include tobacco,

cocaine, energy drinks, ice, coffee, tea, caffeine, dextroamphetamine, Nicotine, among others.

ii. Anti-depressants are medications used to treat depressions and other mental health conditions like anxiety, obsessive-compulsive disorder and phobias. They work by affecting the neurotransmitters in the brain, which are the chemicals that are involved in regulating mood and emotions. They increase the activity of neurotransmitters like serotonin and dopamine. Others work by inhibiting the enzymes that breaks down neurotransmitters. Examples include Duloxetine (Cymbalta), Fluoxetine (Prozac), Trazodone (Desyrel), Escitalopram (Lexapro), paroxetine (Paxil) etc.

Common side effects include nausea, *dizziness, weight gain, sexual dysfunction, and anxiety*. **Mitigations**. *Seek the guidance from the healthcare professional. Limit the use, or use alternative medication.*

iii. Antipsychotic drugs are drugs used to treat mental health conditions like schizophrenia, bipolar disorder and psychosis. They can also be used to manage severe anxiety, depression, disordered thinking and certain psychiatric conditions. Examples include **Clozapine, Quetiapine, Risperidone etc.**

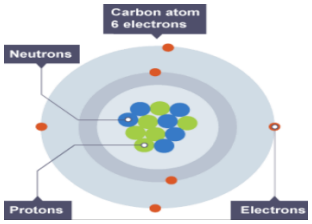
They have various **side effects** associated with the use for example *dry mouth, dizziness, blurred vision, movement effects, loss of menstrual periods in women, weight gain which result into diabetes among others.*

Possible solutions to the challenges are; *adherence to the medication timing from your doctor, limiting the use, stopping the drug or switching to another drug, eating diet rich in proteins and fiber while distancing away from sugar processed foods, doing exercises to manage weight, taking plenty of water, have enough sleep, reduce screen time before bed.*

Nuclear processes.

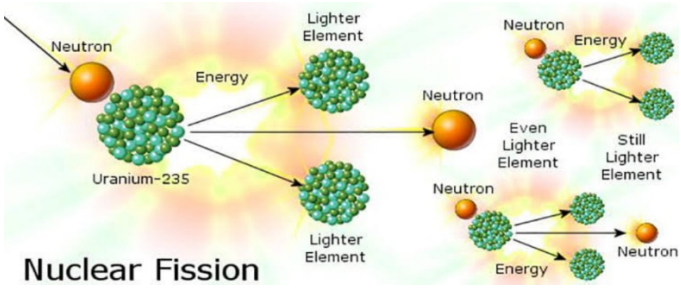
These are chemical processes that involves the reaction of atomic nuclei.

Atoms of certain elements for example uranium and Radium undergo spontaneous (rapid) disintegration (decay) to produce atoms of other elements. This is normally because of the nature of the nuclei, the balance between the proton number and the electron number.



Atoms of elements with a heavy nucleus (proton number> electron number) under spontaneous decay to produce two or more atoms with lighter nuclei. This process is called **nuclear fission.** Atoms with two or more lighter nuclei combine together to form one relatively heavy nucleus. This process is called **nuclear fusion.**

These elements that undergo these processes are called **radioactive elements** and the process of rapid decay is **radioactivity.**



When radioactive elements split, they emit radioactive particles which include; beta, alpha and gamma rays.

Uranium splits to from thorium and a helium particle is emitted.

$$^{236}_{92}U \longrightarrow {}^{234}_{92}Th + {}^{4}_{2}He$$

Other elements that undergo the same process like uranium include *Actinium and Thorium.*

Nuclear reactions.

Nuclear reactions include **nuclear fission** and **nuclear fusion.**

When uranium ($_{92}U^{236}$) is bombarded with slow neutrons, the uranium split into two fragments. This process is called nuclear fission.

The heat energy generated during fission reactions in atomic rector can be utilized for **power production through dynamos and turbines**. The uncontrolled nuclear chain reactions result in ultimate liberation of tremendous amount of heat and other forms of energy which is the principle of atom bomb.

Nuclear fusion (the hydrogen bomb.)

Two or more nuclei may fuse to produce new nuclei. This process is called nuclear fusion. Nuclear fusion involving hydrogen and its isotopes is an exothermic reaction.

$$^{2}_{1}H + {}^{3}_{1}H \longrightarrow {}^{4}_{2}He + {}^{2}_{0}n$$

Fusion reactions are so exothermic and release tremendous amount of energy used in hydrogen bombs. Large amount of energy is required to stat these reactions which is derived from nuclear fission.

Differences between nuclear fission and nuclear fusion.

Nuclear fusion	**Nuclear fusion**
Products are radioactive	Products are not radioactive.
Heavy nuclei split into lighter nuclei	Lighter nuclei fuse to form heavy nuclei.
Reaction can be controlled and can be used for peaceful purpose.	Reaction cannot be controlled.
Fuel is either solid or liquid.	Fuel is in plasma state

Uses of nuclear fission.

- Used in medicine. Radioisotopes are commonly used in diagnosis and treatment of various diseases. They are popular in diagnosis of heart disease, cancer, vitamin deficiency and for metabolism.
- Used in detecting cracks in pipes. I^{131} is used in detecting leakage in underground pipes.

- Used in generation of hydro-electricity power. Fission reactions in nuclear power plant generate heat which produce steam that spin turbines to produce electricity.
- Produces energy for nuclear power and drives the explosion of nuclear weapons.

Dangers of nuclear reactions.

- Release of ionizing radiations can damage DNA leading to gene mutation.
- Leads to cancer.
- Leads to reduction in life span.
- Serious hereditary disease in future generations.

N.B: Make research and write notes about the following;

1. Manufacture of soap; chemical nature of soap and soapless detergents.
2. Cleansing action of soap
3. Differences between soapy and soap less detergent in effective cleaning.
4. Dangers of detergents to the environment.

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