



Primary 5 Integrated Science

Term 3

Theme: MANAGING CHANGES IN THE ENVIRONMENT

Topic 1/4 – Types of Changes – Biological, Physical and Chemical Changes

Biological changes

Biological changes are natural, internal transformations that occur within the bodies of living things (plants, animals, and humans) as they grow, develop, and mature.

Examples of Biological Changes

- (i) **Growth:** An increase in size of animals or plants.
- (ii) **Germination:** A seed growing into a seedling.
- (iii) **Puberty:** Body changes like breast development in girls or voice breaking in boys.
- (iv) **Aging:** Getting old.
- (v) **Molting:** The shedding of skin or feathers (e.g., in snakes or birds).
- (vi) **Growth of body parts:** Hair, nails, and teeth growing.

Exercise 1

- (i) What is a biological change?
- (ii) State two examples of biological changes.

Differences in Biological Changes

In Plants: Germination, flowering, and fruit ripening.

In Animals/Humans: Growth, puberty, and developing new abilities.

Effects of Biological Changes

- (i) **Good effects:** Increased strength, ability to reproduce, improved movement, and better survival skills.
- (ii) **Bad effects:** Aging, susceptibility to diseases, and the eventual death of the organism.

Managing bad biological effects

- (i) Physical exercise slows aging, maintains health of body organs.
- (ii) Balanced diet promotes immunity reducing susceptibility to diseases.
- (iii) Hydration promotes health.
- (iv) Timely treatment of diseases minimized damage to the body.
- (v) Regular medical checkup for early detection of the decline and diseases.

Chemical changes

A **chemical change** is when a substance converts into a completely new substance with different properties. This happens because the particles (atoms and molecules) rearrange themselves to form something new.

Characteristics of a Chemical Change

- (i) **New substance is formed** (e.g., iron → rust, sugar → alcohol).
- (ii) **Usually permanent** and not easy to reverse.
- (iii) **Energy change** often occurs (heat, light, or gas may be released).
- (iv) **Properties change** (color, smell, taste, texture).

Exercise 2

Name two properties of chemical changes

Examples

- (i) Burning wood (wood → ash, smoke, gases).
- (ii) Cooking food (raw ingredients → cooked meal).
- (iii) Fermentation (sugar → alcohol or acids).

Fermentation is the breakdown of sugars by microorganisms (like yeast or bacteria) in the absence of oxygen alcohol and carbon dioxide. Example: yeast fermenting sugar to make beer or bread.

- (iv) Rotting

Rotting is the decomposition of organic matter (like food or plants) caused by bacteria, fungi, and other microorganisms. The breakdown of complex organic compounds into simpler substances, often produces foul odors.

- (v) Decaying

Decaying is similar to rotting but often refers more broadly to the natural breakdown of living tissue after death. Organic matter is decomposed into simpler compounds, eventually returning nutrients to the soil and ecosystem.

- (vi) Respiration

Respiration is the chemical process by which living cells break down glucose (or other food molecules) with oxygen to release energy. The products of respiration are energy (ATP), carbon dioxide, and water. It's essential for survival of most organisms.

- (vii) Rusting of iron (iron + oxygen + water → rust).

When iron is left in damp air for some time it become covered with a brown coat called rust. Chemically rust is hydrated iron III oxide $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$.

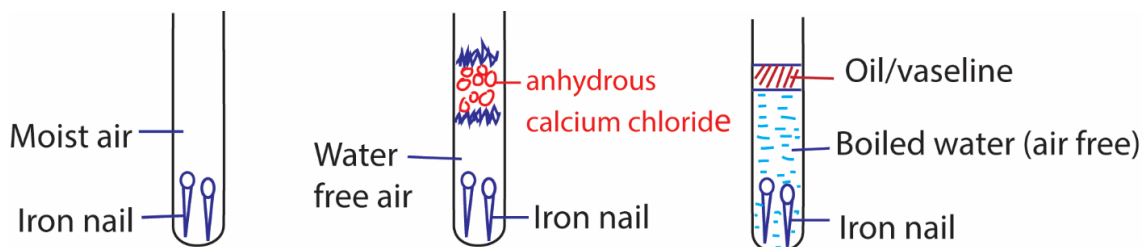
Disadvantage of rusting

- (i) Weaken objects made of iron
- (ii) Makes objects made of iron look ugly

Conditions necessary for rusting

- (i) Oxygen not air
- (ii) Water

Experiment to show that oxygen and water is necessary for rusting



The experiment is set up as shown above and left for several days

1. Test tube A contains nails and moist air
2. Test tube B contains nails and dry air because moisture is removed by anhydrous calcium chloride
3. Test tube C contains nail and air free water; boiling removes dissolved air from water while a layer of oil prevents entry of air into water

Observation after several days

1. In test tube a rusting took place because there is both oxygen and water necessary for rusting to take place.

2. In test tube B rusting did not take place because there was not water
3. In test tube C rusting did not take place due to absence of air

Conclusion

Both oxygen and water are necessary for rusting to take place

Method of preventing rusting

- (i) Keeping iron and steel equipment in air or water free environment, i.e., in the dry places (from water).
- (ii) Oiling (protects equipment from water and oxygen).
- (iii) Painting (protects from both air and water)
- (iv) Tin plating protects iron from both air and water; however, tin-plate is only effective provided the layer of tin remains intact
- (v) Galvanizing: this is coating iron with zinc. Zinc protects iron because it is passive in air but also it can reduce iron III to ion.
- (vi) Alloying

An alloy is a mixture of two or more metals

Examples of alloys

Alloy	Composition	uses
Steel	Iron and carbon	Making cooking utensils, bridges
Bronze	Copper and tin	Ornaments, coins
Brass	Copper and zinc	Coins, ornament
Solder	Tin and lead	Welding

Exercise 3

- (i) What is rusting
- (ii) Give two conditions necessary for rusting to occur.
- (iii) Mention two ways of stopping rusting
- (iv) List the components of steel

Physical changes

Physical changes are temporary alterations where a substance changes its appearance, shape, or state (solid, liquid, gas), but **no new substance is formed**. These changes are usually reversible, meaning the substance can return to its original form.

Key Characteristics of Physical Changes

- (i) **No new substance is formed:** The material remains the same.
- (ii) **Reversible:** Most physical changes can be undone (e.g., freezing water back into ice).
- (iii) **Change in state:** Substance changes between solid, liquid, or gas (e.g., melting, boiling, evaporation).
- (iv) **Change in appearance/form:** Changes in size, shape, or texture.

Exercise 4

State **two** characteristics of physical changes

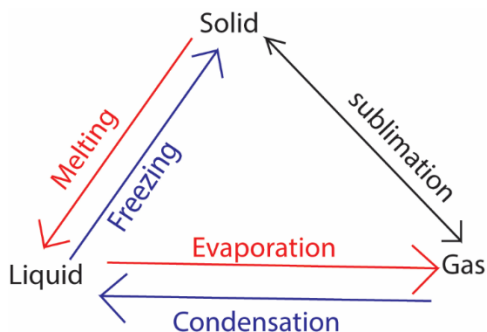
Examples of Physical Changes

- (i) **Melting:** Ice turning into water, or melting wax.
- (ii) **Freezing:** Water turning into ice.
- (iii) **Evaporation/Boiling:** Water turning into steam.
- (iv) **Condensation:** Steam turning back into water.
- (v) **Changing Shape/Size:** Tearing paper, breaking glass, or cutting wood.
- (vi) **Mixing/Dissolving:** Dissolving sugar or salt in water.

Example 5

Give two examples of physical changes.

Summary of physical changes in matter



Exercise 6

What is the meaning of the following physical processes?

- (i) Sublimation
- (ii) Melting
- (iii) Evaporation
- (iv) condensation

Physical vs. Chemical Changes

Unlike physical changes, **chemical changes** create new substances and are usually irreversible (e.g., burning wood, cooking an egg).

Physical Changes in Weather

Weather changes are primarily seen through the shifting of these elements:

- (i) **Temperature Change:** The air becomes hotter or colder depending on the sun's intensity and the time of day.
- (ii) **Formation of Clouds:** Water vapor in the air cools and turns into tiny water droplets. This is a physical change called **condensation**.

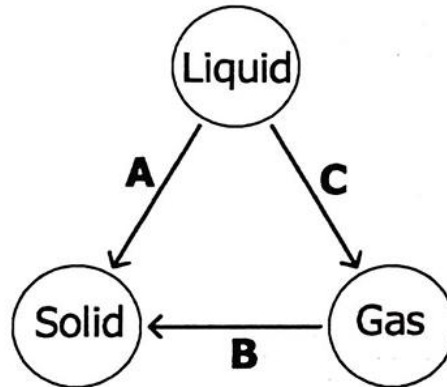
- (iii) **Occurrence of Rain:** When cloud droplets get too heavy, they fall as rain. This is part of a physical cycle called **precipitation**.
- (iv) **Wind Movement:** Air moves from high-pressure areas to low-pressure areas, causing different wind speeds and directions.
- (v) **Change of State:** Water changes between liquid (rain), solid (hail or snow), and gas (water vapor) depending on the temperature
- (vi) **Morning Fog:** Water vapor condensing near the ground; it "disappears" (evaporates) as the sun warms the air.
- (vii) **Drying Puddles:** After it rains, the sun's heat turns the water back into invisible gas (evaporation).
- (viii) **Melting Hail:** Solid ice falling from the sky that turns back into liquid water on the ground

Consequences of various types of changes to: people, animals and plants

- Growth lead to increases in size.
- Chemical change such are respiration cause increases in temperature.
- Vulcanicity leads to Mountain formation.
- Evaporation and condensation cause rain formation.
- Change of state.

Revision exercise

1. The diagram below shows the physical changes that take place in states of matter. Use it to answer the questions that follow.



- (a) Name the physical change labelled A
Freezing
- (b) State any one way in which physical change labelled C is important to plants
Evaporation of water through transpiration cools the plant.
2. (a) Give any two social changes that take place at puberty
- Increased desire for independence** – Adolescents often want more freedom from parents and authority figures.
 - Greater interest in peer relationships** – Friendships and social groups become more important, sometimes even more influential than family.
 - Interest in the opposite sex:** Developing new feelings of attraction or a desire for romantic relationships.
- (b) Mention any two ways through which an adolescent can manage the social changes
- Open communication:** Talking to trusted adults, like parents or teachers, about the feelings and challenges they are facing.
 - Choosing positive peer groups** – Surrounding themselves with supportive friends who encourage good behavior helps them navigate pressures and avoid risky situations.

- (iii) **Engaging in hobbies:** Joining clubs, sports, or religious activities to channel energy into productive skills.
3. State any one way in which fermentation is important in our daily life
- (i) **Food Production:** It is essential for making everyday foods like **bread** (helping it rise), **yogurt**, cheese, and vinegar.
 - (ii) **Food Preservation:** It helps keep food edible for longer periods without it spoiling, such as in **kimchi**, pickles, or sauerkraut.
 - (iii) **Improving Nutrition:** Fermented foods often contain **probiotics**, which are "good bacteria" that help with digestion and keep your gut healthy.
 - (iv) **Production of Alcohol:** It is the process used to create alcoholic beverages like **beer** and wine.
 - (v) **Industrial Uses:** Fermentation is used to produce **biofuels** (like ethanol) and certain medicines like **antibiotics**.
4. Give one example of emotional change
- (i) **Mood Swings:** Suddenly feeling very happy and then quickly feeling sad or annoyed without a clear reason.
 - (ii) **Self-Consciousness:** Becoming very worried about how you look or what others think of you.
 - (iii) **Increased Irritability:** Getting angry or frustrated more easily, especially with parents or siblings.
 - (iv) **Fear/Feelings of Anxiety:** Worrying more about school performance, friendships, or the future.
 - (v) **Need for Privacy:** A strong desire to be alone or have personal space away from family members.
 - (vi) **Increased independence:** A child may feel proud and confident when they can do tasks on their own.

- (vii) **Sense of responsibility:** Feeling more serious or concerned about duties, like schoolwork or helping at home.
- (viii) **Joy and excitement:** Feeling happy about achievements, friendships, or celebrations.
5. (a) Name the physical change which leads to the formation of the following
- (i) Ice: freezing
 - (ii) Rainfall: condensation
- (b) State any two effects of physical changes caused by soil erosion in the environment
- (i) **Loss of Topsoil:** The most fertile upper layer of the soil is washed or blown away, leaving the land bare and unproductive.
 - (ii) **Formation of Gullies:** Deep channels or "small valleys" are carved into the land, making it difficult for people or tractors to move across.
 - (iii) **Silting of Water Bodies:** Eroded soil is deposited into rivers and lakes, making the water shallow and muddy (**sedimentation**).
 - (iv) **Landslides:** On steep slopes, the physical removal of soil stability can cause large masses of earth to collapse.
 - (v) **Desertification:** Over time, the land becomes dry and sandy because it can no longer hold water or support plants.
6. State any one change in food which shows that food has gone bad.
- (i) **Unpleasant Odour (Smell):** Spoiled food often develops a strong, foul, or sour smell. For example, milk smells sour, and meat may smell "putrid" or like chemicals (rancid) when it goes bad.
 - (ii) **Visible Mold:** Fuzzy patches in colors like white, green, black, or blue appear on the surface of foods like bread, fruits, and cheese.

- (iii) **Change in Color:** Food may lose its fresh color and turn brown, grey, or develop dark spots. For instance, fresh red meat might turn a dull grey or brown.
 - (iv) **Texture Alteration:**
 - a. **Sliminess:** A sticky or slimy film often forms on the surface of deli meats or vegetables.
 - b. **Softening/Mushiness:** Fruits and vegetables that were once firm become soft, watery, or "mushy".
 - c. **Hardening:** Bread or cakes can become very hard and dry, which is often called becoming "stale".
 - (v) **Gas Production:** In canned or jarred foods, spoilage bacteria can produce gas that causes the container to **bulge** or swell. You might also see bubbles in liquids like juice or milk.
 - (vi) **Curdling:** In liquids like milk, the texture changes from smooth to lumpy or "curdled" as it spoils.
7. (a) state any two effects of rusting on iron sheets
- (i) Ugly appearance
 - (ii) Holes
- (b) Identify two ways in which people protect iron sheets from rusting.
- (i) Coating with zinc/galvanizing
 - (ii) Painting
 - (iii) Keeping dry
8. (a) Identify any one body change in girls during adolescence
- (i) **Enlargement of breasts:** This is usually the first visible sign of puberty.
 - (ii) **Widening of the hips:** The pelvic bones grow wider to prepare the body for future childbearing.

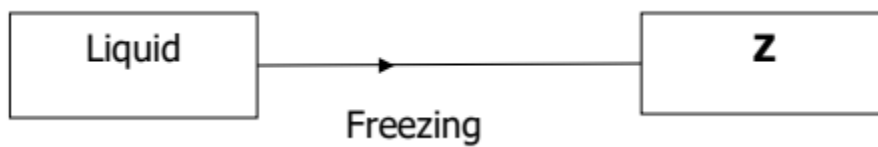
- (iii) **Growth of pubic and underarm hair:** Hair begins to grow in the private parts and under the arms.
- (iv) **Growth spurt:** A rapid increase in height and weight.
- (v) **Onset of menstruation (Periods):** The monthly discharge of blood and tissue from the uterus.
- (vi) **Skin changes:** The skin becomes oilier, which can lead to the development of **pimples** or acne.
- (vii) **Body odour:** Sweat glands become more active, making it necessary to maintain high standards of personal hygiene.

(b) State any two ways in which school boys can help to prevent teenage pregnancies

- (i) **Practicing Abstinence:** Choosing to delay sexual activity until they are older and ready for the responsibilities of adulthood.
- (ii) **Respecting Female Peers:** Refraining from pressuring girls into sexual relationships and respecting their boundaries and decisions.
- (iii) **Avoiding Bad Influence:** Staying away from peer groups that encourage risky behaviors, such as drug use or early sexual relationships.
- (iv) **Promoting a Safe Environment:** Being friendly and supportive toward classmates who may be young mothers, rather than ridiculing or stigmatizing them.
- (v) **Seeking Knowledge:** Actively participating in school health clubs or programs like **PIASCY** (Presidential Initiative on AIDS Strategy for Communication to Youth) to learn about reproductive health and the consequences of early pregnancy.

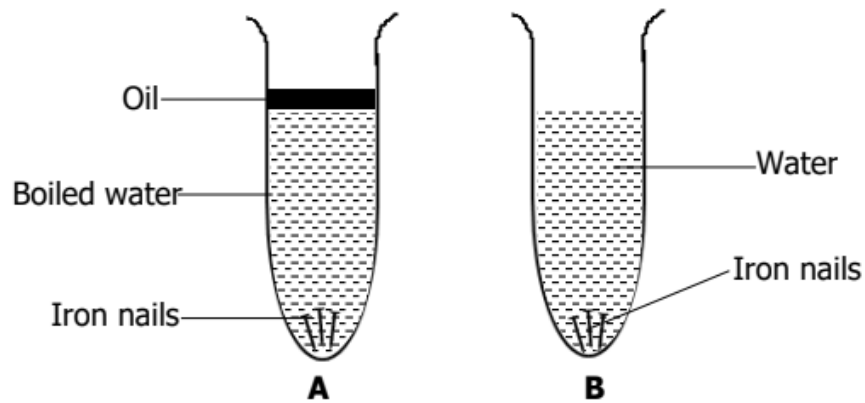
- (vi) **Focusing on Education:** Prioritizing schoolwork and personal goals, which helps them and their peers stay focused on a productive future.
 - (vii) **Encouraging Responsibility:** Challenging harmful attitudes among other boys about what it means to be a "man" and encouraging responsible behavior instead.
- (c) Stat any one way of caring for reproductive system in humans
- (i) **Maintain Personal Hygiene:** Bathe daily and clean the reproductive organs with plain water and mild soap. Always keep the area dry to prevent **fungal infections**.
 - (ii) **Wear Clean, Cotton Underwear:** Cotton allows skin to "breathe" and absorbs moisture. Avoid wearing tight or dirty clothes for long periods.
 - (iii) **Practice Abstinence:** For school-going children, the best way to prevent **Sexually Transmitted Infections (STIs)** and teenage pregnancy is to avoid early sexual involvement.
 - (iv) **Eat a Balanced Diet:** Consuming foods rich in vitamins and minerals keeps the reproductive organs functioning properly and boosts the immune system.
 - (v) **Regular Medical Check-ups:** Visit a doctor if you notice any unusual discharge, itching, or pain. Early treatment prevents long-term damage.
 - (vi) **Proper Menstrual Hygiene:** Girls should change sanitary pads or cloths frequently during their periods to avoid infections and bad odors.
 - (vii) **Avoid Smoking and Alcohol:** These substances can damage the reproductive cells and lead to fertility problems later in life.

9. State any one way in which an adolescent can control bad that result from body changes.
- (i) **Maintain Personal Hygiene:** Bathe at least twice a day with soap and water to wash away sweat and bacteria that cause **body odour**.
 - (ii) **Wear Clean Clothes:** Always wear clean undergarments and socks, preferably made of cotton, to keep the skin fresh and dry.
 - (iii) **Eat Healthy Foods:** Avoid eating too many oily or sugary foods to help reduce the development of **pimples** and acne.
 - (iv) **Practise Abstinence:** Stay focused on your education and avoid early romantic relationships to prevent risks like **STIs** and teenage pregnancy.
10. State the type of change that take place when;
- (a) A knife rusts: chemical change
 - (b) Water freezes: physical change
 - (c) A fruit ripens: biological change
 - (d) Salt dissolves in water: physical change
11. The diagram below shows a change in state of matter. Use it to answer the questions that follow.



- (a) What is the state of matter at Z?
solid
 - (b) Name the process by which Z changes back to a liquid.
Melting
12. What type of change occurs to an egg which has been left in boiling water for more than ten minutes?
Chemical change

13. The diagram below shows an experiment about rusting. Use the diagram to answer the questions that follow



- (a) In which of the containers will the iron rust after some days?
B
- (b) Why would the iron nails in the container you have identified rust?
It has both water and oxygen
- (c) Give **one** reason why oil was poured in container A
To prevent entry of oxygen
- (d) What would happen to the nails if they were painted before being put in the containers?
They would not rust in each of the containers
14. Give one biological change in plants
- (i) **Seed Germination:** The process where a seed absorbs water and sprouts into a **seedling**.
- (ii) **Vegetative Growth:** The physical increase in the plant's size, including the development of more **leaves**, stems, and roots.
- (iii) **Flowering:** The transition from the vegetative stage to the reproductive stage, where the plant produces **flowers**.

- (iv) **Pollination and Fertilization:** The transfer of pollen leading to the formation of **seeds** and fruits.
 - (v) **Wilting:** A physical change where a plant loses water and its leaves droop (this can be reversible if the plant is watered).
 - (vi) **Fruit Ripening:** The change in a fruit's texture, color, and sweetness as it becomes ready for dispersal.
15. By what process is alcohol formed from fruit juice
Fermentation
16. Name the process by which water turns into ice
Freezing
17. (a) Name the change of state which takes place when;
- (i) Vapor changes to liquid: condensation
 - (ii) A solid changes directly to gas; sublimation
- (b) A part from causing change of state, give two other effects of heat on matter
- (i) **Expansion:** Matter increases in size or volume when heated. For example, metal rails or air in a balloon expand when they get hot.
 - (ii) **Rise in Temperature:** Heat causes the temperature of an object to go up, making it feel hotter.
 - (iii) **Chemical Change:** Heat can cause substances to react or decompose, such as when paper burns or food is cooked.
18. (a) What is the mixture of two or more metals
Alloy
- (b) Give one example of a common mixture of metals.
Steel, solder, bronze
- (c) How does heat move from one point to another in a metal?
By conduction

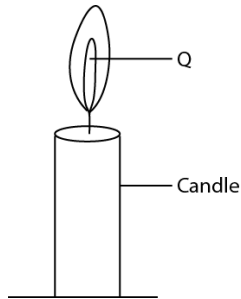
(d) Apart from painting, give any one method of preventing a metallic object from rusting.

By oiling

By galvanizing

By oiling

18. The diagram below is of a burning candle. Use it to answer question(a) and (b)



(a) What two forms of energy are given off at Q?

(i) Light

(ii) heat

(b) What gas is supporting the process?

oxygen

(c) What other process in living thing produces the same gas as the candle?

Respiration

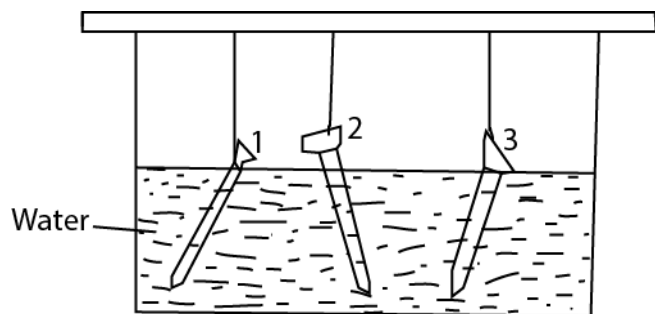
Germination

19. Nails were placed in water as indicated below for one week .us the information to answer to answer the question that follow.

-Nail 1 was painted

-Nail 2 was not painted

-Nail 3 was greased.



(a) Which of the nails above have changed its colour overnight?

Nail 2

(b) What will grease do in nail 3 above?

Prevents water and air from reaching the nail

(c) Why are metal object painted?

To prevent it from contact with oxygen and water

(d) Which nails will remain unaffected?

Nail 1 and 3

20. Give any one reason why the burning of wood is a chemical change.

It is irreversible

A new substance (ash) is formed

21. How does painting a metal prevent it from rusting?

Keeps water and oxygen from the metal

22. (a) what is a chemical change?

This is an irreversible change from one form of a substance to another requiring or involving heat and/or light

(b) Give any one example of a chemical change.

Rusting of iron

Burning of firewood

(c) When water change to ice the process is called freezing. Name the process in each of the following changes:

(i) Ice to water **melting**

(ii) Steam to water: **evaporation**

23. Apart from painting, give any one other way in which metal can be prevented from rusting.

By oiling

Keeping in dry places

Greasing

Galvanizing

24. (a) Gives any two example of a physical change
- (i) melting of ice
 - (ii) Evaporation
 - (iii) Gas to solid
 - (iv) Melting candle wax
- (b) State two characteristics of a chemical change
- (i) Heat is given out
 - (ii) Form new substance
 - (iii) Are irreversible
 - (iv) Permanent change
25. In which type of change are the properties of the substance formed permanently different from those of the original one?

Chemical change

26. (a) What type of change takes place when an iron tool rusts?
- Chemical change**
- (b) Give two conditions necessary for rusting to take place on an iron tool
- (i) **oxygen (not air)**
 - (ii) **water**
- (c) State any one effect of rusting on iron tools.
- **weakens tools**
 - **make tools dull/ugly**
 - **make tool blunt**

Thank You

Dr. Bbosa Science