paper. We cannot combine the products of burning of paper to form the original paper again. So, it is a permanent change. Now, shall we perform an activity of burning a piece of magnesium ribbon and find what type of change is it?

What do you observe?

You can see that the magnesium ribbon starts burning with a dazzling white light. Hold the burning magnesium ribbon over a watch glass so that the powdery ash being formed by the burning of magnesium collects in the watch glass.

When magnesium ribbon burns in air, then the magnesium metal combines with the oxygen of air to form a new substance called magnesium oxide.

Magnesium + Oxygen ⟶ Magnesium oxide

$2Mg + O_2 \longrightarrow 2MgO$

Magnesium oxide compound appears as a white powdery ash.

The burning of magnesium ribbon is a chemical change, because a new substance, magnesium oxide, is formed during this change.

3.4.3 Curdling of milk

We know that curdling of milk is an example of irreversible change since we cannot get back the milk after curdling occurs. It is also called as a chemical change. Shall we clarify the process of curdling?

Curdling is a process in which liquid gradually turns into solid, forming clumps along the way. Take hot milk in a pan and add few drops of curd, in few minutes milk curdles forming lumpy solid masses. We can even add lemon extract to the hot milk to effect curdling immediately, but the taste and texture of the curd will not be the same as that of the curdling occurring in a few hours. You can try to taste the curd formed by immediate curdling and gradual curdling.

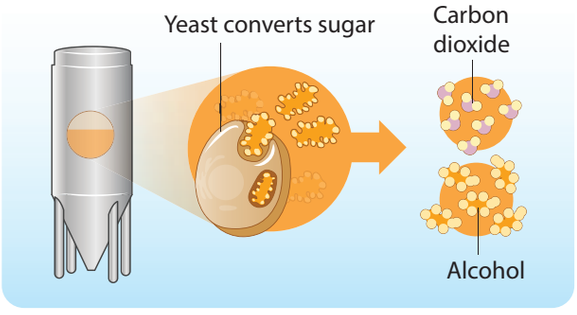
L5I2R4

3.4.4 Fermentation

In class six, we saw an example that preparation of batter to produce idly is an example for irreversible change.

Fermentation is the process in which microorganisms such as yeast and certain bacteria break down sugar solution into alcohol and carbon-di-oxide.

It is an irreversible process as the alcohol formed cannot be turned back into sugar. Thus, fermentation is a chemical change.



Louis Pasteur (1822-1895), a French chemist and microbiologist was the first person to describe the process of fermentation.

He described that fermentation occurs in the absence of air and in the presence of micro organisms such as yeast. He discovered the cure for rabies.

3.4.5 Chemical reaction of baking soda with lemon

Baking soda is sodium hydrogen carbonate and lemon juice contains citric acid. So, when these two substances are mixed together, then a chemical change takes place between sodium hydrogen carbonate and citric acid to form three new substances: sodium citrate, carbon-di-oxide and water. The chemical change can be written in the form of a word equation as follows:-

Sodium hydrogen carbonate + citric acid → sodium citrate + carbon dioxide + water

ACTIVITY 8

When baking soda and lemon juice are mixed together, then bubbles of carbon-di-oxide are formed along with the formation of some salt and water. Take 10 ml of lemon juice and add pinch by pinch of baking soda to it. Actually when we mix baking soda with lemon juice, we will hear a hissing sound when bubbles of carbon-di-oxide coming out and rising in the reaction vessel.

3.5 Conditions needed for a chemical change

We know that firing of crackers is a chemical change. Some crackers explode only when thrown against a wall or struck with a hard substance. Thus, we could see that c**hange in pressure** may also bring about a chemical change.

When lemon juice is mixed with soda water, they produce brisk effervescence which is otherwise not possible when they are separate. So we can say that many chemical changes occur only when the **substances are made to physically contact with each other.**

We have tasted raw rice and cooked rice, Have not we? They are different in their taste. Cooking is a process that is involved in the stated example, wherein rice is boiled with sufficient water. It is the heat and the water that had brought the change in texture and taste of the rice before and after cooking. Thus we can say that **heating** is a condition needed for a chemical change to occur.

We know the use of vanaspathi in cooking vanaspathi is obtained from vegetable oils by addition of hydrogen to the oils. nickel, platinum or palladium are used as catalyst during the process of hydrogenation of oils.

Catalysts are substances that speed up the process of a chemical change and it will not undergo any change during the course of the reaction. For example, yeast acts as the catalyst in the fermentation of sugar. You will learn more about catalyst in your higher classes.

Water is a chemical compound that remains as water when undisturbed. But if a few drops of an acid is added to water and subjected to electrolysis by passing electric current, it decomposes into hydrogen and oxygen. So, we can understand that **electric current** is also a condition that is needed for effecting a chemical change.

Thus we can conclude that physical contact of the substances, heat, light, electricity, applying pressure are some of the different conditions needed for chemical changes to occur.

3.6 Indicators of a chemical change

Take some broken pieces of egg shell in a test tube and add lemon juice to it. You could see bubbles of carbon-di-oxide evolving in the test tube. This is because of the chemical change between the two. Hence, we can say that evolution of bubbles serve as an indicator that of a chemical change.

When water is added to quicklime (calcium oxide) there will be evolution of lot of heat along with the formation of slaked lime (calcium hydroxide). This is a chemical change and it is indicated by the evolution of heat when the reaction sets in between quicklime and water.

Every day we cook food stuffs and clean the empty cooking utensils. Suppose when we leave the cooked utensils with some cooked food and leave them without washing for a day, we could sense a foul-smell coming from the vessels the next day. This is because the food stuff had become rotten and produces a foul-smell. Here spoilage of food is a chemical change and it is indicated by the foul smell. So, change of odour is also an indicator of a chemical change.

When an iron nail is kept in water for a few days and taken out, the nail will become reddish brown in colour indicating that it has rusted. We know that rusting is a chemical change and it is indicated by a change in colour of the iron nail.

We know that hot milk curdles to form white lumps of curd when mixed with lemon juice. A lump of curd is the precipitate that is obtained by the chemical reaction between hot milk and lemon juice. So, formation of precipitate is also an indication of a chemical change.

To conclude, there can be evolution of bubbles, evolution of heat, change of odour, change in colour or formation of a precipitate that serve as indicators for us to understand that a chemical change had taken place.

3.7 Exothermic and Endothermic chemical changes

B9L8I5

Just as the physical change, Chemical reaction will be either endothermic or exothermic.

ACTIVITY 9

Ask a student to stretch both hands, put a pinch of soap powder in one hand and a pinch of glucose in the other hand. Add a few drops of water to soap powder and ask how the student feels upon adding water. Now add a few drops of water to the glucose at the other hand. Now ask the student how he /she feels on adding water, What is the feeling when water is added to glucose?

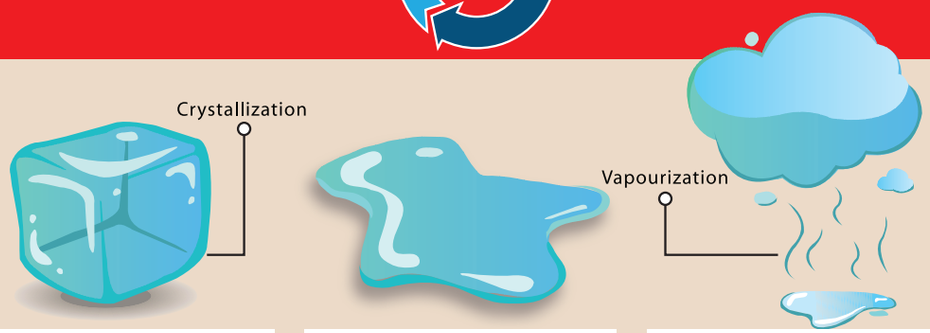
.....

What is the difference when water is added to soap powder and when water is added to glucose?

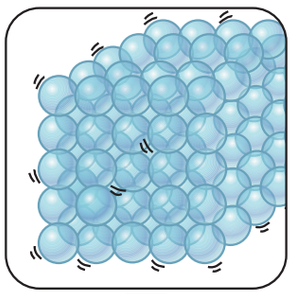
.....

In this activity, the student reported that he / she felt the warmness in the palm when water is added to soap powder. Right! We saw that the burning of magnesium ribbon gives out heat and light. Similarly, burning of wood also releases heat and light. Such changes in which heat is released are known as exothermic changes.

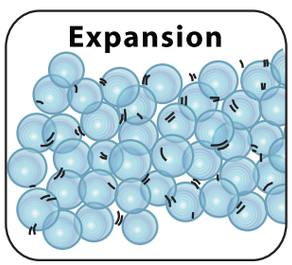
Endothermic Exothermic



Particles of Solids

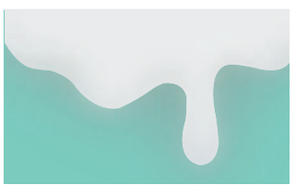


heated

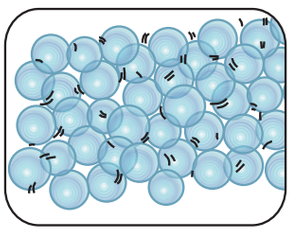


Becomes Liquid

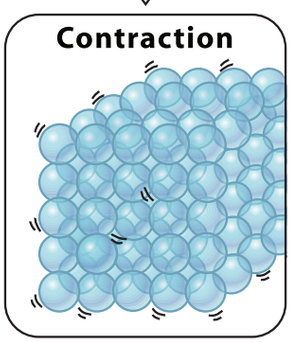
MELTING



Particles of Liquids



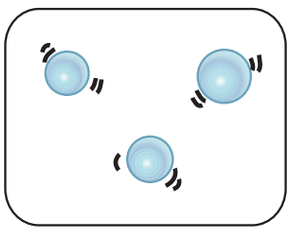
cooled



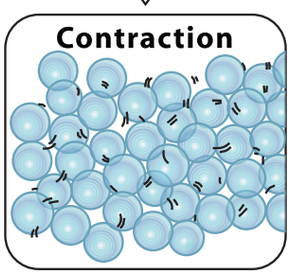
Becomes Solid

FREEZING

Particles of Gas

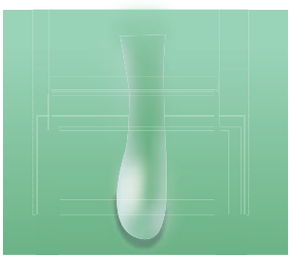


cooled



Becomes Liquid

CONDENSATION

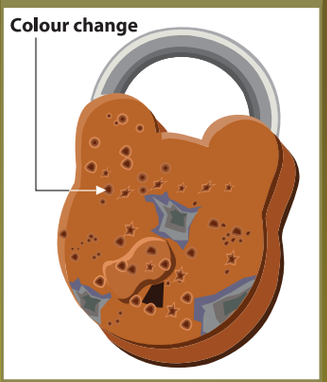


PERIODIC CHANGE

NON-PERIODIC CHANGE

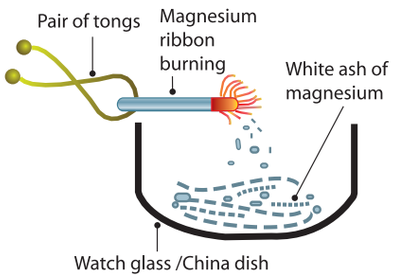
MIXING EGG SHELL OR BAKING SODA WITH LEMON JUICE

RUSTING OF IRON

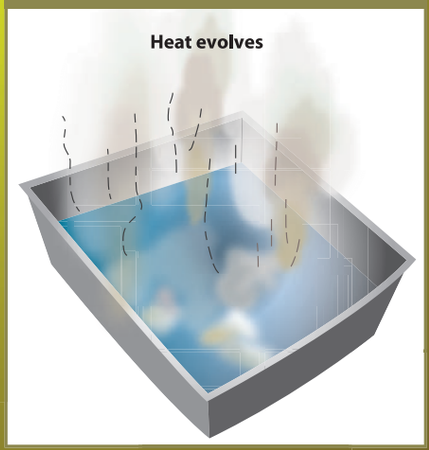


BURNING OF MAGNESIUM RIBBON

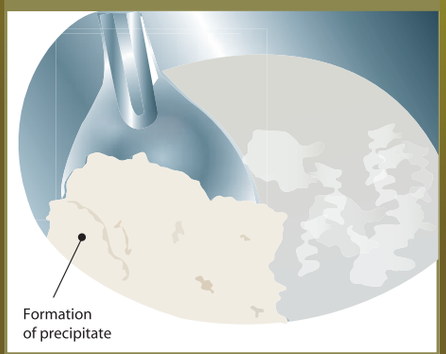
Formation of new product:
Magnesium oxide



MIXING QUICK LIME WITH WATER



CURDLING OF MILK



THUNDERSTORM

There are some changes in which heat is absorbed. For example, water absorbs heat when it evaporates to form water vapours. Similarly ice absorbs heat when it melts to form water. Such changes in which heat is absorbed are known as endothermic changes. Dissolution of glucose in water is also an endothermic change.

3.8 Periodic and non-periodic change

Depending on whether or not a change repeats itself after a definite period of time, it can be classified as periodic change or a non-periodic change.

Periodic changes

Changes that repeat themselves after a definite interval of time are called **periodic changes.**

Rotation and Revolution of earth, beating of the heart, clock striking every hour, motion of the seconds-hand / minute-hand / hour-hand of a clock are some examples of periodic changes.

Every year we observe that seasons changes. We go from rains to winter and winter to summer and so on.

- What types of clothes are worn in winter?

- What are the clothes that we wear in summer? ---

If the winter season changes into summer, we observe change in the texture type of clothes we wear. We wear woolen clothes in winter and cotton clothes in summer. Similarly, we observe that the winter season is cool and summer season is hot. In winter, duration of night is longer than in summer. We take cold drinks in summer but prefer hot tea, coffee or milk in winter. These changes that we observe show the change of seasons.

The seasons and changes in weather occur because earth rotates on its fixed axis. Changing seasons are almost periodic in nature.

Non-periodic changes

Changes that do not repeat themselves after a definite interval of time and occur randomly are called **non-periodic changes**. Eruption of a volcano, occurrence of an earthquake, a streak of lighting flash across the sky during a thunderstorm, running of a batsman between the wickets, movement of legs while dancing are a few examples of non-periodic changes.

POINTS TO REMEMBER

- Particle arrangement within the state of matter gets disturbed upon heating. The disturbance is seen either as expansion or contraction.
- A process in which liquid changes into vapour on heating is called evaporation.
- A process in which solid changes into liquid on heating is called melting or fusion.
- A process in which gas changes into a liquid is called condensation.
- A process in which liquid changes into solid is called freezing.
- Physical changes are the changes in which only physical properties of a substance undergo a change and there is no change in its chemical composition.
- Solid substances are usually purified by the process of crystallization.
- Evaporation is the technique used to separate dissolved solids from a solid-liquid mixture.
- Certain solid substances like camphor, naphthalene get converted into gas directly without becoming liquid upon heating by sublimation.

- ❖ Changes that occur with the formation of new substance with different chemical composition or transformation of a substance into another substance with the evolution or absorption of heat or light energy are termed as chemical changes.
- ❖ Changes that repeat themselves after a definite interval of time are called periodic changes.
- ❖ Changes that do not repeat themselves after a definite interval of time and occur randomly are called non-periodic changes.
- ❖ Changes in which heat is absorbed are known as endothermic changes.
- ❖ Changes in which heat is released are known as exothermic changes.

Evaluation

I. Choose the best answer

1. When a woolen yarn is knitted to get a sweater, the change can be classified as _____ .
   a. physical change b. chemical change
   c.endothermic change
   d. exothermic change
2. _____ of the following are endothermic changes.
   a. Condensation and melting
   b. Condensation and freezing
   c. Evaporation and melting
   d. Evaporation and freezing
3. The chemical change is _____ .
   a. water to clouds
   b. growth of a tree
   c. cow dung to bio-gas.
   d. ice-cream to molten ice-cream.
4. _____is an example of a periodic change.
   a. Earthquake.
   b. Formation of rainbow in sky
   c. Occurrence of tides in seas.
   d. Showering of rain
5. _____ is not a chemical change.
   a. Dissolution of ammonia in water
   b. Dissolution of carbon-di-oxide in water
   c. Dissolution of oxygen in water
   d. Melting of polar ice caps

II. Fill in the blanks

1. Filling up a balloon with hot air is a _____ change.
2. Stretching gold coin into a ring is a _____ change.
3. Opening a gas cylinder knob converts _____ fuel into _____ fuel. This is an example of _____ change.
4. Spoiling of food is a _____ change.
5. Respiration is a _____ change.

III. True or False. If false, give the correct answer.

1. Cutting of cloth is an example of a periodic change.
2. Taking a glass of water and freezing it by placing it in the freezer is a chemical change.
3. A bean plant collecting sunlight and turning it into bean seeds is an example of physical and non-periodic change.
4. If the chemical properties of a substance remain unchanged and the appearance or shape of a substance changes it is called a periodic change.
5. Tarnishing of silver is an example of endothermic change.

IV. Match the following

A	B	C
1. Melting	Change of state from liquid to solid	Ticking of clock
2. Condensation	Change of state from liquid to gas	Formation of ice cube
3. Evaporation	Change of state from solid to liquid	Collecting flowers
4. Freezing	Change of state from gas to liquid	Ice cube to water
5. Periodic change	Occurs at irregular time intervals	Water to steam
6. Non-periodic change	Occurs at regular time intervals	Steam to water drops

V. Classify the following changes as physical and chemical changes

A rough piece of wood is sanded and polished resulting in change in texture, Rusting of a iron nail, Painting the grill, Bending a paper clip, Pounding silver into thin plate, Rolling the chappathi dough into thin wire, Occurrence of day and night, eruption of volcano, burning of matchstick, dosa from the batter, blinking of eyelids, occurrence of a thunderstorm, rotation of the earth, formation of eclipses.

Physical changes	Chemical changes

VI. Analogy

1. Physical Change: Boiling::Chemical Change: _____.
2. Wood to saw dust:_____ :: Wood to Ash: Chemical change
3. Forest fire: _____ change::Change in period in a school: periodic change

VII. Very short answer type question

1. State two examples of periodic changes.
2. Mention any two exothermic reactions.
3. Cold milk is heated and it becomes hot. Which type of change it is?
4. What type of change is artificial ripening of fruit?
5. What type of change is colouring of a paper?
6. Growing of nails is a periodic change. Why?
7. What type of energy changes is associated when ice melts?

VIII. Short answer type question

1. Distinguish physical and chemical changes.
2. How can a change occur in a substance?
3. Can you suggest a method to collect water from sea water?
4. Is solar eclipse a periodic change? Give your reason.
5. What is the difference between dissolution of sugar and burning of sugar?

IX. Long answer type question

1. Explain the following statement: Digestion is a chemical change.
2. How the iron blade is fixed into a wooden handle in tools used to dig the soil?

X. Higher order Thinking questions

1. Peeled and unpeeled banana does not look the same. Does that mean peeling banana is a chemical change?
2. A very hot glass on putting in cold water cracks. What does this change indicate?
3. Boiling of water is a physical change; but boiling of egg is a chemical change. Why?

XI. Assertion – Reason type question

1. Assertion: The explosion of fire cracker is a physical change.

Reason: A physical change is a reversible change.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

2. Assertion: The process of conversion of liquid water to its vapours by heating the liquid is called boiling.

Reason: The process of conversion of water vapours to liquid by cooling the vapours is called condensation.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

3. Assertion: Burning of wood log to charcoal is a physical change.

Reason: The products formed of burning a piece of wood can be easily converted back to wood log.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

4. Assertion: The formation of iron oxide from iron is a chemical change.

Reason: For the rust to form from iron, it must be exposed to air and water.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

5. Assertion: A drop of petrol when touched with finger gives a chill feeling.

Reason: The above phenomenon is an endothermic one.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c.A is true but R is false.

d. A is false but R is true.

XII. Picture based question

1. Observe the picture and list down the changes that are accompanied in the picture.

a) ……..

b) ……

c) ……..

2. Observe the picture containing a kettle and note that it has salt water in it and answer the following questions:

a) What is name of the process that is done to the kettle?

b) What will happen to the content of the kettle?

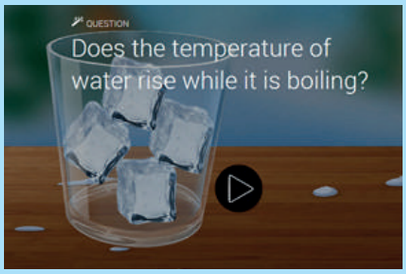
c) What kind of change is occurring on the cold surface of the metal plate?

d) What can you say about the quality of water that is obtained in the beaker?

ICT CORNER

CHANGES AROUND US

This activity helps the students to understand the effect of heat on matters



PROCEDURE :

Step 1: Type the URL link given below in the browser or scan the QR code. A page opens with a glass full of ice with a play button near to it.

Step 2: Press Play button. It opens into another page with the set up of temperature and change of phases.

Step 3: Set the temperature and phases. Press the play button below.

Step 4: Do it with different options. Then a next page button will come

Step 5: Go there you will end with a small quiz.

Step 1

Step 2

Step 3

Step 4

Changes Around Us URL:

https://interactives.ck12.org/simulations/chemistry/phases-of-matter/app/index.htmlm

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.

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