



CHANGES AROUND US



Concepts Covered

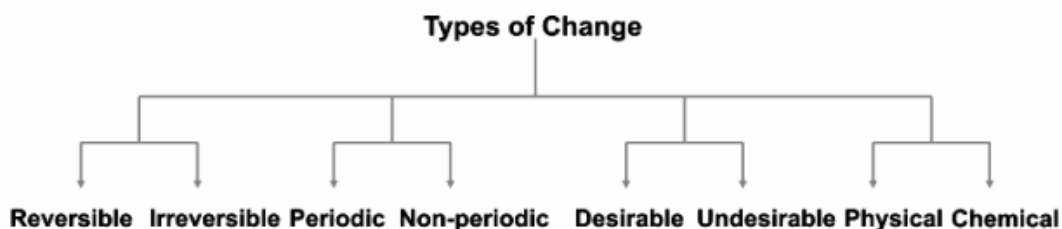
- Classification of Changes
- Reversible and Irreversible changes, Desirable and Undesirable changes, Periodic and Non-Periodic changes
- Physical and Chemical changes, Slow and Fast changes

Introduction

Various kinds of changes occur around us all the time. Some of the changes are natural. Man has no control over natural changes. Changes in weather and season and the growth of plants and animals are two examples of natural changes. Burning of fuel, cooking of food, etc., are examples of man-made changes. At home, we see changes in a matter like cooking of rice, pulses and vegetables, drying of wet clothes, boiling of water, formation of curd from milk, etc. Thus, we see many types of changes around us. Some changes can be seen quite easily while some other changes are difficult to detect. In this chapter, we look at the characteristics of all the changes that happen around us and then classify them to make their study easier.

Types of Changes

If we look at the different changes that occur around us more carefully, we will see that the changes have certain features.



1. Some changes are slow while others are fast.

Examples: Rusting of iron with and curdling of milk are slow changes. Burning of a matchstick with and switching on/off an ordinary bulb are fast changes.

2. Some changes are natural while others are manmade.

Examples: Formation of coal deep in the earth's crust over millions of years with and the flow of a river to join the sea are natural changes. Creating a breeze by switching on a fan with and heating of food on a gas stove are man-made changes.

3. Some changes are desirable while other changes are undesirable.

Examples: Cooking of rice grains with and boiling of milk are desirable changes. Floods and earthquakes are undesirable changes.

4. Some changes are periodic while others are non-periodic changes.

Examples: Day changing to night and winter season changing to spring season are periodic changes. Rainfall and snowfall are non-periodic changes.

5. Some changes are reversible while others are irreversible.

Examples: Formation of ice from water with and heating cold water are reversible changes. Burning of coal with and curdling of milk are irreversible changes.

6. Some changes alter the physical state while others alter chemical composition of the substances.

Examples: Water turning to steam is a change in the physical state while burning of coal is a chemical change.

7. Some changes take place with the release of heat while others take place with the absorption of heat.

Changes that take place with the release of heat are called Exothermic changes while those that take place with the absorption of heat are called Endothermic changes.

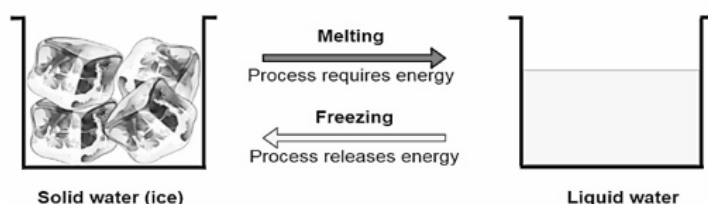
Examples: Water absorbs heat energy (on being heated) to form steam and releases heat energy (on being cooled) to form ice. Formation of steam is an endothermic change while formation of ice is an exothermic change.

Reversible and Irreversible Changes

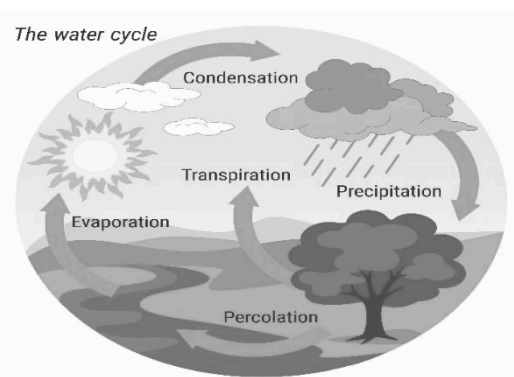
Reversible Change

A reversible change is a change that takes place in such a way that the original situation can be restored by altering the conditions. A few examples will help you understand this better.

1. When ice melts it forms water. On cooling, the same water gets converted to ice again.



Interconversion of ice into liquid water and vice-versa

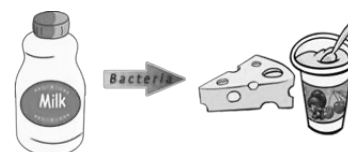


2. Water from the rivers and seas evaporates, forms clouds, and falls in the form of rain. The rainwater flows into the rivers and seas from where it again evaporates.
3. When weight is suspended on a spring balance, it stretches and as soon as the weight is removed the spring comes back to its original form.
4. The heating of an electric heater on switching on and cooling on switching off are reversible changes.

Irreversible Change

An irreversible change is a change that takes place in such a way that the original situation cannot be restored even after the conditions are altered. A few examples will help you understand this better.

1. Milk can be changed into curd, cheese, ice-cream etc. but these milk products cannot be changed back into milk.
2. On being heated, sugar gets charred, i.e., it forms a black mass. But if you cool charred sugar, you cannot get back sugar in its original form.
3. Other day-to-day examples: burning of coal, wood, paper or kerosene, photosynthesis in plants, the digestion of food in our body, the clotting of blood, the growth of plants and animals, etc.



Milk changed into cheese and ice-cream



Burning of Wood

Physical and Chemical Changes

Physical Change

A physical change is a change that can be reversed by reversing the conditions in which no new matter is formed. Thus, there are two important conditions for a physical change.

Condition 1: No new matter is formed in the change.

Condition 2: The change is reversible.

These two conditions are used to determine whether a change is a physical change or not.

Characteristics of a Physical Change:

- No new substance is formed.
- Reversible change.
- Chemical property of substance remains the same.
- Change in colour, shape, size, and state.
- No energy is liberated.

Specific Examples of Physical Changes:

The most common examples of physical changes are changes in the physical states of matter. When there is only a change in the physical state of matter, no new matter is formed, and the original physical state can be restored by changing the conditions.

1. Freezing and Melting of matter:

Freezing: On being cooled to 0°C , water freezes to give ice. On being heated, ice melts to give back water. So, the freezing of water is a reversible change. No new matter is formed when water freezes. Hence, the freezing of water is a physical change. In fact, the freezing of any liquid is a physical change.

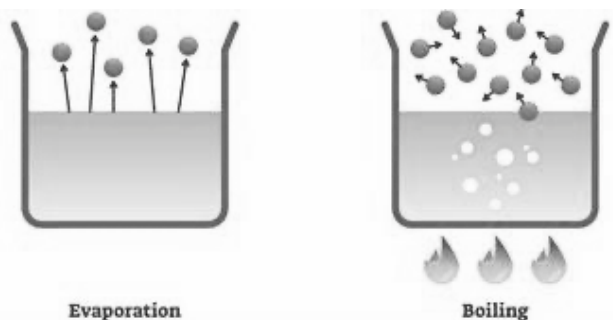
Melting: When an iron piece is heated to its melting point it melts. No new matter is formed. The molten iron changes back to solid when cooled. Thus, the change is reversed by reversing the condition (heating is replaced by cooling). Hence, the melting of iron is a physical change. In fact, the melting of any solid is a physical change.

2. Vaporization and Evaporation are physical changes.

Vaporization: When a liquid is heated to its boiling point it changes a gaseous or vapour state. The vapours when cooled change back to liquid.

Evaporation: Evaporation takes place continuously at the surface of the liquid. The vapours thus formed if cooled change back to liquid.

Thus, both vaporization and evaporation are physical changes as they both are reversible and no new matter is formed.



3. Dissolving of sugar, salt, glucose and many other solids: If the solution is heated for a sufficient time the water evaporates and the dissolved matter is left behind. Hence, dissolution is a physical change.

Chemical Change

A chemical change is a change in which new matter is formed and which is not reversible even if the conditions are reversed. Thus, there are two important conditions for a chemical change.

Condition 1: New matter is formed in the change.

Condition 2: The change is permanent and not reversible.

These two conditions are used to determine whether a change is a chemical change or not.



Check Your Concept - 1

- (i) Conversion of a solid to liquid by heating is called
(A) Evaporation (B) Melting
(C) Condensation (D) Freezing
- (ii) Which of the following is not a man-made change?
(A) Change of day & night (B) Burning of fuels
(C) Drying of clothes (D) Tearing of paper
- (iii) On heating metal rim, it:
(A) Expands (B) Contracts
(C) Depends on heat (D) No Change



The mass of individual substances undergoing a chemical change is altered.

For example, when carbon is burnt in air, the amount (i.e., the mass) of carbon reduces and finally the carbon vanishes. In fact, all the carbon gets converted to carbon dioxide. On the other hand, if an iron nail is allowed to rust, the mass of the rusted nail is more than that of the original nail.

Characteristics of a Chemical Change

1. New matter is formed.
2. There is a change in the mass of the original matter (see box).
3. The composition and the properties of the new matter are different.
4. The change is permanent and cannot be reversed.
5. There is an exchange of energy during a chemical change. This means that heat and light are either given out or consumed.

Specific Examples of Chemical Change

1. Cooking food is a chemical change. Food is cooked to make them edible by heating it on a stove. If the food is cooled, can we get back the raw grain and vegetables from the cooked food? No, we cannot. The composition of the cooked food has changed. The cooked material does not retain its new form even after being cooled. This shows that the change is permanent and irreversible.
2. The curdling of milk is a chemical change. When milk is curdled, curd is formed and we cannot get back milk from the curd. The change is irreversible.
3. Digestion of food is a chemical change. Food digested inside the body cannot be changed back to food. Digested food is completely different from the food that we eat.



Cooking of food

Differences Between Physical and Chemical Changes

Physical Change	Chemical Change
A physical change is temporary.	A chemical change is permanent.
A physical change is reversible.	A chemical change is irreversible.
No new matter is formed after a physical change.	New matter is formed after a chemical change.
After a physical change, the mass of the substance does not change.	The mass of the matter undergoing a chemical change is altered.

Some changes involve both physical and chemical changes:

1. Burning of a candle: The following changes occur when a candle burns:
 - a. The wax under the wick gets heated and melts. The molten wax flows down and solidifies. The changes in state from solid to liquid and again from liquid to solid are physical changes.
 - b. A part of the molten wax vaporizes and catches fire to burn and form new substances - carbon dioxide and water vapour. This change is irreversible. So, the burning of wax is a chemical change.
2. Take a spoon of sugar on a pan and heat it:
 - a. You will observe that sugar first melts and then changes its colour to reddish brown. Ultimately it turns black and gets charred. Now stop heating and allow the mass to cool. We cannot get back sugar even if the condition is reversed.
 - b. New matter - carbon dioxide and water vapour form on heating sugar. But they do not recombine to give sugar even if cooled.



Check Your Concept - 2

- | | |
|--|--|
| (i) Burning of paper is
(A) Chemical Change
(C) Reversible | (B) Physical Change
(D) All of These |
| (ii) Melting of wax is
(A) Chemical Change
(C) Both (A) and (B) | (B) Physical Change
(D) None of These |
| (iii) Temperature at which a solid starts melting is called its
(A) Melting Point
(C) Freezing Point | (B) Boiling Point
(D) Slow Change |

Changing of milk into curd

A common food served in almost all homes is curd. The yogurt that is curd's cousin is most frequently confused with it. Few people are aware of the differences between curd and yogurt and how they are processed. Yogurt and curd are very different from one another.

When an acidic substance, such as vinegar or lemon juice, is introduced to milk, the milk protein tangles up into curd, which are solid masses. The whey, or water that has been separated, is drained out to leave only the curd behind. Curdling is the term for the action of milk coagulating to generate curd.

Lactic acid bacteria can also be added to raw or heated milk to make curd. Additionally, curds form when milk is left out in the open without being chilled.

Yogurt - The milk is fermented and becomes curd when it is brought to a medium or moderate temperature, mixed with some buttermilk, and left for 5 to 6 hours. The bacterial fermentation of milk produces yogurt. Lactic acid is created when "yogurt cultures" of bacteria ferment lactose, aiding in the production of yogurt. Yogurt is made using the "Lactobacillus delbrueckii" bacterial culture.

In India, Yogurt is commonly called Dahi and Curd. Hence, the process of making curd from milk using lactic acid bacteria is called curdling, while yogurt is formed by the fermentation of lactobacillus bacteria. The yogurt can be diluted by adding water, to make buttermilk.



Curd

Desirable and Undesirable Changes

Desirable Change:

A desirable change is useful to humans. Milk changing to curd, cleaning of utensils, etc., are examples of desirable changes.



Milk to Curd

Undesirable Change:

An undesirable change is harmful to human as it causes destruction. Floods, earthquakes, droughts, etc., are examples of undesirable changes.



Fuel is any material that stores energy that can later be extracted to perform mechanical work in a controlled manner.



Earthquake

Natural and Man-Made Changes

Natural Change:

The change that takes place without any artificial interference are Natural changes. Natural changes take place on their own. Man has no control over them. The formation of coal from dead and decaying plants is an example of a natural change that takes place over thousands of years.



Natural Change

Man-made Change:

The change that occurs due to the action of humans are known as Man-made changes. The extraction of iron from iron ore is an example of a man-made change. Man-made changes or artificial changes like the burning of fuels are changes that are brought about by man.



Burning of fuels

Changing Seasons

The seasons are caused by Earth's tilted axis. Different regions of the Earth are exposed to the Sun's strongest rays at various times of the year. Therefore, the Northern Hemisphere experiences summer when the North Pole tilts toward the Sun. Additionally, winter in the Northern Hemisphere occurs when the South Pole tilts toward the Sun.

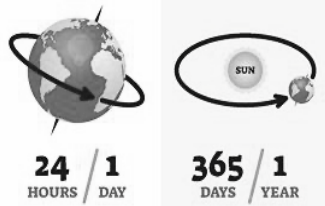
We notice the seasons changing every year. Rains give way to winter, which gives way to summer, and so on. We notice a difference in our clothing when winter turns into summer. As an illustration, wearing woollen clothing in the winter switches to wearing cotton clothing in the summer. In a similar vein, we see that summer is hot and winter is chilly. The length of the night is longer in winter than it is in summer.

Periodic and Non-Periodic

Periodic Change

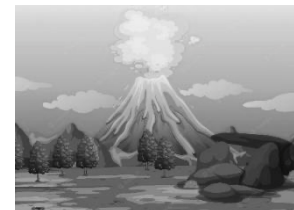
The change that occurs repeatedly after regular intervals of time is a periodic change. Since periodic changes occur repeatedly at regular intervals of time they are predictable.

For example, we know that as the sun sets, the night will come. Rising of the sun in the morning and Set in the evening, seasons like summer, rains, winter, heartbeat of living animals, high tides and low tides in a sea, etc., are examples of periodic changes.



Non-Periodic Change

Some changes that occur irregularly, are called non-periodic changes. Non-periodic changes are unpredictable and often cause havoc or inconvenience. Earthquakes, accidents, solar and lunar eclipse, landslides, sneezing, etc., are examples of non-periodic changes. The eruption of a volcano is unpredictable and a non-periodic change.

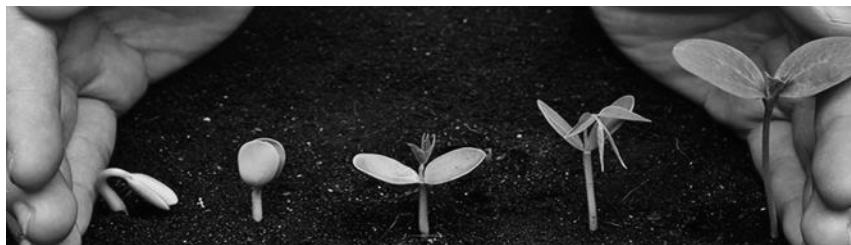


Observing the changes in shadow during winter and summer seasons.

The tilt of the Earth's axis affects the length of our shadows. During the summer, our location is tilted towards the Sun, so our mid-day shadows are very short. During the winter, our location is tilted away from the Sun, so our mid-day shadows are longer.

Slow and Fast Changes

Slow Change: The change that requires a long time (a few hours or even days) to occur are slow changes. The growth of a plant, rusting of iron, ripening of fruit, curdling of milk and conversion of seed into plant are some examples of changes that take place over a long period. Germination of a seed to a plant takes a long time, sometimes a few years.



Germination of a Seed to a plant

Fast Change: The change that occurs in a short time (immediately or in a few minutes) are fast changes. Burning of paper, changing of ice into water, explosion of a cracker, etc., are some examples of changes that take place over a short period. Lightning and its effects are felt in a few seconds.



Lightning

Indicators and Causes for change:

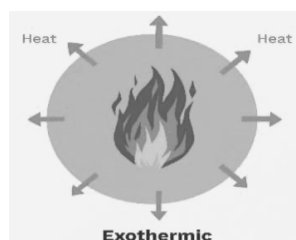
S.No.	Change	Indicators for Change	Causes of Change
1.	Change from milk to curd.	Change in state, taste and smell.	The small quantity of curd added to warm milk makes certain bacteria to grow in the milk and it converts to curd.
2.	Change in seasons.	Change in dress we wear, the slight change in the coldness or hotness of air, direction of sunrise, food/drinks we take, usage of water, fruits and flowers available duration of a day.	The slight change in the direction of sunrise.

Exothermic and Endothermic Changes

Exothermic Change

A change in which energy in any form is released is called an exothermic change.

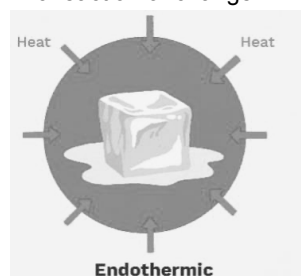
Examples: Burning of fuels, Electric stove that is switched on, A glowing bulb.



Endothermic Change

A change in which energy in any form is absorbed is called an endothermic change.

Examples: Melting ice absorbs heat energy. To curdle milk, the milk should be lukewarm. This means that heat is absorbed in the formation of curd. It is an endothermic reaction or change.



Solved Examples

(1) A drawing sheet changes when you draw a picture on it. Can you reverse this change?

Answer: We can reverse this change only if pencil is used for drawing by using an eraser. If a pen or paint is used for drawing, then we cannot reverse this change.

(2) You accidentally dropped your favourite toy and broke it. This is a change you did not want. Can this change be reversed?

Answer: No, this change cannot be reversed. Because the breaking of a toy is an irreversible change, one cannot regain the same toy.

(3) A thick coating of a paste of Plaster of Paris (POP) is applied over the bandage on a fractured bone. It becomes hard on drying to keep the fractured bone immobilised. Can the change in POP be reversed?

Answer: No, the change in POP cannot be reversed because it is an irreversible chemical change.

(4) A bag of cement lying in the open gets wet due to rain during the night. The next day, the sun shines brightly. Do you think the changes which have occurred in the cement, could be reversed?

Answer: No, the changes which have occurred in the cement cannot be reversed because it is an irreversible chemical change.

(5) Shivani sister broke a white dove, a symbol of peace, made of Plaster of Paris (POP). Shivani tried to reconstruct the toy by making a powder of the broken pieces and then making a paste by mixing water. Will she be successful in her effort? Justify your answer.

Answer: Shivani will not be successful because making toy from Plaster of Paris (POP) is a change that cannot be reversed.

(6) Explain why the burning of paper is said to be an irreversible change whereas the boiling of water is known as reversible change.

Answer: If we burn a piece of paper, it changes into ash and smoke. Now, we cannot combine the ash and smoke to form the original piece of paper. So, the burning of paper is a change that cannot be reversed. Hence, the burning of paper is an irreversible change.

When we boil water by heating then it changes into steam. Now, if we cool the steam, then water is formed again. So changing of water into steam has been reversed by cooling. Thus, the boiling of water is reversible change.

(7) What is the difference between the following changes:

(a) Rolling a roti from dough. (b) Baking of a roti.

Answer: (a) We can convert this rolled roti back into the ball of dough. This means that the rolling of roti out of dough is a change which can be reversed and also it is a physical change. So, the rolling out of dough is a reversible and physical change.

(b) Baked roti cannot be changed back into the original ball of dough. So, the baking of roti is an example of change which cannot be reversed and also it is a chemical change. Thus it is an irreversible and chemical change.

(8) Write three different applications of expansion and contraction of materials.

Answer: Following are the applications of expansion and contraction of materials:

The jammed metal lid of a jam jar can be expanded and opened by heating. In many thermometers, mercury is used. When the bulb of the thermometer comes in contact with a hot object, the mercury expands and its level rises in the glass tube, indicating the temperature. The electric lines are never hung tautly between poles because in the outside environment wires are subjected to extreme weather conditions, ranging from acute hot to cold temperature. In winters, a taut wire on contraction can snap.

(9) How does a blacksmith change a piece of iron into different tools and what change has taken place in iron, on being heated?

Answer: A blacksmith first heats a piece of iron till it becomes red hot. It then becomes soft and can be beaten into the desired shape. Iron when heated and beaten forms some shape and again heated regains its initial iron. Thus, this change is a reversible change.

(10) When is a change said to have taken place in a material? Explain with an example.

Answer: We have many things around us. All these things have certain properties such as state (liquid, solid, gas), position, shape, size, colour, temperature, composition, and structure, etc. When one or more properties of a thing become different, we say that it has changed or a change has taken place, changes involve different kind of alterations in the things around us.

When a change takes place, there may be a change in the state, position, colour, temperature, composition or structure of the material of the object. When an ice melts, it forms water. Ice is a solid whereas water is a liquid. So, the melting of ice involves a change in state (from solid to liquid state).

Exercise

FILL IN THE BLANKS

- (1) If we blow a balloon the shape and size of balloon has changed. This is a _____ change.
- (2) If cold water is poured over a hot metal ring it _____.
- (3) Water vapour changes into _____ when it is cooled.
- (4) When water is heated, it changes into _____.
- (5) Conversion of water vapour into liquid water is a _____ change.
- (6) Take a glass of water. Dissolve two teaspoons sugar in it. These are changes in water which can _____ (Be reversed/not be reversed).
- (7) Many materials expand on being _____.
- (8) On being heated, a gas expands _____ than a solid does.
- (9) Periodic changes occur after regular _____.
- (10) Breaking ice-cube into two pieces is a _____ change.

TRUE OR FALSE

- (1) Some changes can be reversed, some cannot be reversed.
- (2) Raw egg is boiled. We can reverse this change.
- (3) A sheet of paper is changed into a toy aeroplane by folding it. This is a reversible change.
- (4) Milk to paneer is a reversible change.
- (5) Metal expands on heating.
- (6) All changes around us can be reversed.
- (7) Evaporation of water is reverse of condensation of water.
- (8) Rust is formed when iron reacts with oxygen.
- (9) Railway tracks contracts in summer.
- (10) Tearing paper is a reversible change.

OBJECTIVE TYPE QUESTIONS

- (1) Pick the change that can be reversed from the following:

(A) Cutting of Trees	(B) Melting of Ghee
(C) Burning of Candle	(D) Blooming of Flower
- (2) Which of the following changes cannot be reversed?

(A) Hardening of Cement	(B) Freezing of Ice-cream
(C) Opening a Door	(D) Melting of Chocolate
- (3) An iron ring is heated. Which of the following statements about it is incorrect?

(A) The ring expands.
(B) The ring almost comes to the same size on cooling.
(C) The change in this case is reversed.
(D) The ring changes its shape and the change cannot be reversed.
- (4) Rolling of chapati and baking of chapati are the changes that

(A) Can be reversed
(B) Cannot be reversed
(C) Can be reversed and cannot be reversed respectively
(D) Cannot be reversed and can be reversed respectively
- (5) Which of the following is a reversible change?

(A) Raw egg to boiled egg	(B) Stretched rubber band to its normal
(C) Bud to flower	(D) None of these
- (6) Which of the following is an example of physical change?

(A) Mix baking soda and vinegar together, and this causes bubbles and foam.
(B) A glass cup falls from the counter and shatters on the ground.
(C) Lighting a piece of paper on fire and the paper bums up and leaves ashes.
(D) Baking a birthday cake for your mother.
- (7) If a few drops of petroleum are poured on your palm, you feel cool as the petrol evaporates. This change is

(A) Slow Change	(B) Chemical Reaction
(C) Endothermic Change	(D) Periodic Change

- (8) Why is spoiling food considered a chemical change?
 (A) In it the food changes from one chemical substance to another
 (B) It is not possible to get original food from spoiled food
 (C) It is a permanent change
 (D) All the above
- (9) Why is an earthquake considered a non-periodic change?
 (A) Its occurrence is possible at any time.
 (B) It occurs rarely at some places.
 (C) It occurs only in certain quake prone areas.
 (D) None of above.
- (10) The melting of gold is a physical change because
 (A) Melted gold is still gold but in different form
 (B) No new substance is formed in it
 (C) On cooling melted gold returns back to its original state
 (D) All the above

Answer Key

CHECK YOUR CONCEPT

- | | | | |
|-----|-------|--------|---------|
| (1) | (i) B | (ii) A | (iii) A |
| (2) | (i) A | (ii) B | (iii) A |

FILL IN THE BLANKS

- | | |
|------------------|--------------------------|
| (1) Reversible | (6) Not to be reversed |
| (2) Contracts | (7) Heated |
| (3) Liquid Water | (8) More |
| (4) Water Vapour | (9) Regular Interval |
| (5) Reversible | (10) Irreversible Change |

TRUE OR FALSE

- | | |
|-----------|------------|
| (1) True | (6) False |
| (2) False | (7) True |
| (3) True | (8) True |
| (4) False | (9) False |
| (5) True | (10) False |

OBJECTIVE TYPE QUESTIONS

- | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| (B) | (A) | (D) | (C) | (B) | (B) | (C) | (D) | (A) | (D) |