Chapter 5: Changes Around Us: Physical and Chemical

Exercises — Let Us Enhance Our Learning

Q1 Which of the following statements are the characteristics of a physical change? (i) The state of the substance may or may not change. (ii) A substance with different properties is formed. (iii) No new substance is formed. (iv) The substance undergoes a chemical reaction. (a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iii) (d) (iii) and (iv)

SOLUTION

Recall the definition from the chapter: a physical change is one in which a substance or object undergoes a change in its physical properties (shape, size, state) and no new substance is formed.

Check each statement:

Statement (i): 'The state of the substance may or may not change.' — TRUE for physical changes. Ice melting (state changes) and folding paper (state does not change) are both physical changes.

Statement (ii): 'A substance with different properties is formed.' — This describes a CHEMICAL change, not a physical change. INCORRECT for physical changes.

Statement (iii): 'No new substance is formed.' — TRUE and the key defining feature of a physical change.

Statement (iv): 'The substance undergoes a chemical reaction.' — This defines a chemical change. INCORRECT for physical changes.

Therefore, the correct pair is (i) and (iii), which is option (c).

Answer: (c) (i) and (iii)

Q2 Predict which of the following changes can be reversed and which cannot be reversed. (i) Stitching cloth to a shirt (ii) Twisting of straight string (iii) Making idlis from a batter (iv) Dissolving sugar in water (v) Drawing water from a well (vi) Ripening of fruits (vii) Boiling water in an open pan (viii) Rolling up a mat (ix) Grinding wheat grains to flour (x) Forming of soil from rocks

SOLUTION

(i) Stitching cloth to a shirt — Can be reversed by cutting/removing the stitches and separating the cloth pieces. The cloth itself is unchanged. Reversible.

(ii) Twisting of straight string — Can be reversed by untwisting the string back to

its original straight form. Only the shape/arrangement changes. Reversible.

(iii) Making idlis from a batter — Cannot be reversed. The batter undergoes chemical changes during steaming (proteins denature, starch gelatinises). We cannot get the original batter back. Not reversible.

(iv) Dissolving sugar in water — Can be reversed by evaporating the water; the sugar crystallises back. The sugar and water are not chemically changed. Reversible.

(v) Drawing water from a well — Can be reversed by pouring the water back into the well. It is simply a change of location. Reversible.

(vi) Ripening of fruits — Cannot be reversed. Ripening involves chemical changes (breakdown of starches, formation of sugars and aromatic compounds). The original unripe fruit cannot be restored. Not reversible.

(vii) Boiling water in an open pan — If steam escapes into the air, the water is lost and cannot be collected easily in the same pan. In practice, this is not easily reversible in an open pan (though condensing the steam elsewhere would recover water). Not easily reversible in an open pan.

(viii) Rolling up a mat — Can be reversed by unrolling the mat. Only shape/position changes. Reversible.

(ix) Grinding wheat grains to flour — Cannot be reversed. The grain is broken into very fine particles; the original grain structure cannot be restored. Not reversible.

(x) Forming of soil from rocks — Cannot be reversed. This involves both physical (breaking) and chemical (weathering) changes over thousands of years; the original rock cannot be restored from soil. Not reversible.

Answer: Reversible: (i), (ii), (iv), (v), (viii). Not reversible: (iii), (vi), (vii), (ix), (x).

Q3 State whether the following statements are True or False. In case a statement is False, write the correct statement. (i) Melting of wax is necessary for burning a candle. (ii) Collecting water vapour by condensing involves a chemical change. (iii) The process of converting leaves into compost is a chemical change. (iv) Mixing baking soda with lemon juice is a chemical change.

SOLUTION

(i) 'Melting of wax is necessary for burning a candle.' — TRUE.

Explanation: When a candle is lit, the heat of the flame melts the wax. The liquid wax is drawn up the wick by capillary action and evaporates. It is the wax vapour that actually burns. Without melting, the wax cannot travel up the wick and cannot

burn.

(ii) 'Collecting water vapour by condensing involves a chemical change.' — FALSE.
Correct statement: Collecting water vapour by condensing involves a physical change. Condensation is a change of state from gas (water vapour) to liquid (water); no new substance is formed and the change is reversible.

(iii) 'The process of converting leaves into compost is a chemical change.' — TRUE.
Explanation: Decomposition of leaves by bacteria and fungi involves chemical reactions that break down complex organic molecules into simpler substances (compost). New substances are formed, so it is a chemical change.

(iv) 'Mixing baking soda with lemon juice is a chemical change.' — TRUE.
Explanation: Lemon juice contains citric acid. When it reacts with baking soda (sodium hydrogen carbonate), carbon dioxide gas is produced (observed as fizzing/bubbling). A new substance (CO_2) is formed, confirming a chemical change.

Answer: (i) True. (ii) False — condensation is a physical change. (iii) True. (iv) True.

Q4 Fill in the blanks: (i) Nalini observed that the handle of her cycle has got brown deposits. The brown deposits are due to _____, and this is a _____ change. (ii) Folding a handkerchief is a _____ change and can be _____. (iii) A chemical process in which a substance reacts with oxygen with evolution of heat is called _____, and this is a _____ change. (iv) Magnesium, when burnt in air, produces a substance called _____. The substance formed is _____ in nature. Burning of magnesium is a _____ change.

SOLUTION

(i) Brown deposits on the cycle handle are rust (iron oxide), formed when iron reacts with oxygen and moisture in the air. Rusting produces a new substance (iron oxide), so it is a chemical change.
Answer: brown deposits are due to rusting (rust/iron oxide), and this is a chemical change.

(ii) Folding a handkerchief only changes the shape of the cloth; the cloth itself is unchanged and can be unfolded to its original form.
Answer: Folding a handkerchief is a physical change and can be reversed.

(iii) The chapter defines combustion as a chemical reaction in which a substance reacts with oxygen and produces heat and/or light. Combustion is a chemical change because new substances are formed.
Answer: The process is called combustion, and this is a chemical change.

(iv) From the chapter: when magnesium ribbon is burnt in air (oxygen), it produces magnesium oxide (a white powder). Magnesium oxide is a new substance formed by the chemical reaction, so the burning of magnesium is a chemical change.
Answer: Magnesium when burnt produces magnesium oxide. The substance is white (powdery/solid) in nature. Burning of magnesium is a chemical change.

Answer: (i) rusting, chemical. (ii) physical, reversed. (iii) combustion, chemical. (iv) magnesium oxide, white/solid, chemical.

Q5 Are the changes of water to ice and water to steam, physical or chemical? Explain.

SOLUTION

Both changes — water to ice and water to steam — are physical changes.

Water to ice (freezing): Water changes from the liquid state to the solid state. Only the state of matter changes; the substance remains water (H_2O) in both cases. No new substance is formed. The change is reversible — ice can melt back to water.

Water to steam (vaporisation/boiling): Water changes from the liquid state to the gaseous state (steam). Again, only the state of matter changes; the substance is still water (H_2O). No new substance is formed. The change is reversible — steam can condense back to liquid water.

In both cases, only the physical property (state of matter) changes and no chemical reaction occurs. Therefore, both are physical changes.

Answer: Both are physical changes. Only the state of matter (solid/liquid/gas) changes; the substance remains water (H_2O) with no new substance formed, and both changes are reversible.

Q6 Is curdling of milk a physical or chemical change? Justify your statement.

SOLUTION

Curdling of milk is a chemical change.

Justification:
When milk curdles, the proteins in the milk (mainly casein) react chemically with an acid (such as lactic acid produced by bacteria, or lemon juice/vinegar if added deliberately). This reaction causes the proteins to coagulate and precipitate out, forming curd (solids) and whey (liquid).
New substances are formed — the composition of the curd is different from that of the original milk.
The change cannot be reversed — curd cannot be converted back to the original milk.
The formation of new substances with different properties confirms that curdling is a chemical change.

Answer: Curdling of milk is a chemical change. New substances (curd and whey) with different properties are formed, and the change cannot be reversed.

Q7 Natural factors, such as wind, rain, etc., help in the formation of soil from rocks. Is this change physical or chemical and why?

SOLUTION

The formation of soil from rocks (weathering) involves BOTH physical and chemical changes.

Physical changes involved:
Temperature changes due to climatic conditions cause rocks to expand and contract, developing cracks.
Growing roots of trees widen these cracks, breaking rocks into smaller pieces.
Freezing of water inside rock cracks forces them apart.
Wind and flowing water carry and grind rock particles, breaking them into smaller fragments (erosion).
In all these cases, only the size and shape of the rock change; no new substance is formed.

Chemical changes involved:
Water and chemicals dissolved in rainwater react with the minerals in rocks, altering their chemical composition.

For example, the chapter describes basalt (a black rock containing iron) chemically reacting with water or air containing water vapour to form a red layer of iron oxide — a new substance.
This constitutes a chemical change because a new substance (iron oxide) is formed.

Therefore, weathering of rocks to form soil involves both physical changes (breaking/grinding) and chemical changes (reaction with water/chemicals), and the overall process is not reversible.

Answer: Formation of soil from rocks involves both physical changes (breaking, grinding by wind/water/roots) and chemical changes (minerals in rocks reacting with water/chemicals to form new substances like iron oxide). It is not reversible.

Q8 Read the story 'Eco-friendly Prithvi' and tick the most appropriate option(s):
Prithvi chops vegetables, peels potatoes, and cuts fruits (physical changes/chemical changes). He collects the seeds, fruits, and vegetable peels into a clay pot (physical change/chemical change). The fruits, vegetable peels, and other materials begin to decompose due to the action of bacteria and fungi, forming compost (physical change/chemical change). He plants seeds; after a few days, the seeds germinate and small plants start to grow, eventually blooming into colourful flowers (physical change/chemical change).

SOLUTION

Event 1 — Chopping vegetables, peeling potatoes, cutting fruits:
These involve only changes in size and shape. No new substance is formed. → Physical changes.

Event 2 — Collecting seeds, fruits, and vegetable peels into a clay pot:
This is simply a change in location/arrangement. No new substance is formed. → Physical change.

Event 3 — Decomposition by bacteria and fungi to form compost:
Bacteria and fungi break down complex organic matter through chemical reactions, forming new substances (compost) with different properties. → Chemical change.

Event 4 — Seeds germinating and plants growing, eventually blooming into flowers:
Germination and growth involve chemical reactions within the seed and plant

(breakdown of stored food, synthesis of new cells, formation of pigments in flowers). New substances are formed at each stage. → Chemical change.

A suitable title for the story: 'From Kitchen Waste to Garden Bloom' or 'Prithvi's Eco-Cycle'.

Answer: Chopping/peeling/cutting — physical changes. Collecting into a pot — physical change. Decomposition to compost — chemical change. Seeds germinating and plants growing into flowers — chemical change. Suggested title: 'From Kitchen Waste to Garden Bloom'.

Q9 Sort the following changes: write physical changes in area 'A', chemical changes in area 'B', and changes that are both physical and chemical in area 'C'. Changes: Process of burning a candle; Tearing of paper; Rusting; Curdling of milk; Ripening of fruits; Melting of ice; Folding of clothes; Burning of magnesium; Mixing baking soda with vinegar.

SOLUTION

Classify each change:

Tearing of paper — only the size/shape of paper changes; no new substance formed. → Physical change (Area A).
Melting of ice — water changes state from solid to liquid; no new substance formed; reversible. → Physical change (Area A).
Folding of clothes — only the shape changes; no new substance formed; reversible. → Physical change (Area A).

Rusting — iron reacts with oxygen and moisture to form iron oxide (rust), a new substance. → Chemical change (Area B).
Curdling of milk — proteins in milk react chemically to form curd (new substance). → Chemical change (Area B).
Ripening of fruits — chemical reactions change the composition of the fruit (starches convert to sugars, pigments form). New substances are formed. → Chemical change (Area B).
Burning of magnesium — magnesium reacts with oxygen to form magnesium oxide, a new substance; heat and light are also produced. → Chemical change (Area B).
Mixing baking soda with vinegar — carbon dioxide and other new substances are formed. → Chemical change (Area B).

Process of burning a candle — the wax melts and evaporates (physical changes), while the wax vapour burns to produce carbon dioxide and water (chemical change). Both types occur simultaneously. → Both physical and chemical (Area C).

Answer: A (Physical): Tearing of paper, Melting of ice, Folding of clothes. B (Chemical): Rusting, Curdling of milk, Ripening of fruits, Burning of magnesium, Mixing baking soda with vinegar. C (Both): Burning a candle.

Q10 The experiments shown in Fig. 5.11a, b, c, and d were performed. Find out in which case(s) did lime water turn milky and why? (a) Vinegar and baking soda → gas passed into lime water. (b) Lemon juice and vinegar → gas passed into lime water. (c) Vinegar and common salt → gas passed into lime water. (d) Lemon juice and baking soda → gas passed into lime water.

SOLUTION

Lime water turns milky when carbon dioxide (CO_2) is passed through it. CO_2 reacts with calcium hydroxide (lime water) to form calcium carbonate, which is insoluble and makes the water appear milky.

The key question for each experiment is: Does the reaction produce carbon dioxide?

(a) Vinegar and baking soda:
Vinegar is an acid (acetic acid). Baking soda is sodium hydrogen carbonate ($NaHCO_3$). Acids react with carbonates/bicarbonates to produce carbon dioxide gas. This reaction is demonstrated in Activity 5.4 of the chapter.
→ CO_2 is produced. Lime water TURNS MILKY.

(b) Lemon juice and vinegar:
Both lemon juice and vinegar are acids (citric acid and acetic acid respectively). Mixing two acids does not produce carbon dioxide — there is no carbonate present to react with.
→ No CO_2 is produced. Lime water does NOT turn milky.

(c) Vinegar and common salt:
Vinegar is an acid; common salt (sodium chloride, NaCl) is a neutral salt — not a carbonate or bicarbonate. No carbon dioxide is produced when an acid reacts with common salt under these conditions.
→ No CO_2 is produced. Lime water does NOT turn milky.

(d) Lemon juice and baking soda:
Lemon juice contains citric acid. Baking soda is a bicarbonate. Acid reacts with bicarbonate to produce carbon dioxide gas (the same type of reaction as in (a)).
→ CO_2 is produced. Lime water TURNS MILKY.

Answer: Lime water turns milky in experiments (a) and (d). In both cases, an acid reacts with a bicarbonate (baking soda) to produce carbon dioxide, which turns lime water milky. In (b) and (c), no CO_2 is produced (acid+acid and acid+salt respectively), so lime water stays clear.