



Answers

Chemical Reactions

Year 8 Science

Chapter 7

p146	<p>1 Physical change happens when a substance changes from one form to another form but keeps exactly the same chemical composition.</p> <p>2 Indicate why each of the following are physical changes:</p> <ol style="list-style-type: none">The freezing of water involves the changing from liquid water to solid ice but water keeps exactly the same chemical composition.Solid sugar disappears in water when dissolved but the sugar and the water keep exactly the same chemical composition. <p>3 All of the pictures on the left show a physical change because each substance keeps exactly the same chemical composition.</p> <p>4 Examples of physical change are: Boiling water, condensation of water, melting ice, moisture forming on the outside of a cold glass, breaking a glass, a limb falling off a tree, cutting paper with a pair of scissors, sharpening a pencil, mashing a potato, evaporating alcohol.</p>
p147	<p>1 Chemical change happens when a new substance is formed. Chemical change happens when a substance combines with another substance to form one or more new substances. Chemical change happens when a substance breaks down into two or more substances. Chemical change is not reversible except with further chemical change.</p> <p>2 Indicate why each of the following are chemical changes:</p> <ol style="list-style-type: none">Rusting iron is a chemical change because a new substance is formed by the combination of iron with oxygen: $4\text{Fe} + 3\text{O}_2 + 6\text{H}_2\text{O} \rightarrow 4\text{Fe(OH)}_3$Toasting bread is a chemical change because the change is irreversible. <p>3 All of the pictures on the left show a chemical change because each of them produce a new substance.</p> <p>4 Can you think of 10 more examples of chemical change? Making bread, baking a cake, digestion in the small intestine, saliva acting on food, a burning candle, rotting wood, rotting fruit.</p>
p149	<p>1 The following evidence can suggest that a chemical, chemical reaction, has taken place: Change of colour, Change in temperature, Change of smell, Change of form, Production of gases, Production of a precipitate, Decomposition of organic material, Light or sound is produced.</p> <p>2 An exothermic reaction produces heat.</p> <p>3 An endothermic reaction absorb heat.</p> <p>4 The rusting of iron can be summarised by the symbolic equation: $4\text{Fe} + 3\text{O}_2 + 6\text{H}_2\text{O} \rightarrow 4\text{Fe(OH)}_3$</p> <ol style="list-style-type: none">The symbol for iron is FeThe evidence that rusting is a chemical change is the formation of a new substance. <p>5 The evidence that the ripening of fruit is a chemical change is a change in colour.</p>

p151	<p>1 Smell and taste can be used as evidence of a chemical change. Smell and taste should be avoided because it can be dangerous.</p> <p>2 Combustion is the chemical combination of a substance with oxygen and produces heat.</p> <p>3 A precipitate is the formation of a solid in a solution during a chemical reaction.</p> <p>4 Which of the following is a chemical change and which is a physical change?</p> <ul style="list-style-type: none"> a) Building a sand castle on the beach - physical change. b) Painting a desk green - physical change. c) Lighting a candle - chemical change. d) Cooking biscuits - chemical change. e) Bending/snapping a light stick to produce a glow chemical change. <p>5 The chemical reaction of baking soda and calcium chloride produces a precipitate. The symbolic equation is: $2\text{NaHCO}_3 + \text{CaCl}_2 \rightarrow \text{CaCO}_3 + 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$ The symbolic formula of the precipitate is CaCO_3</p>
p153	<p>1 Combination reactions occur when two or more substances combine to form a new substance.</p> <p>2 X and Y are the reactants and XY is the product.</p> <p>3 A lit splint is used for the test of hydrogen: Hydrogen gas burns with a ‘pop’ sound and extinguishes the lit splint.</p> <p>4 Hydrogen will react explosively with oxygen to produce water: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$</p> <p>5 Combustion is the chemical combination of a substance with oxygen and produces heat.</p> <p>6 $\text{C} + \text{O}_2 \rightarrow \text{CO}_2 + \text{heat}$</p> <p>7 $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO} + \text{heat}$</p> <p>8 $\text{Fe} + \text{S} \rightarrow \text{FeS}$</p> <p>9 $\text{S} + \text{O}_2 \rightarrow \text{SO}_2$</p>
p155	<p>1 Decomposition reactions occur when a substance breaks down to form two or more new substances.</p> <p>2 XY is the reactant and X and Y are the products.</p> <p>3 The electrolysis of water decomposes water into hydrogen and oxygen.</p> <ul style="list-style-type: none"> a) $\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2$ b) A lit splint is used for the test of hydrogen: Hydrogen gas burns with a ‘pop’ sound and extinguishes the lit splint. c) A glowing splint (no flames burning) is used to test for oxygen. Oxygen gas rekindles the glowing splint as it bursts into flames. <p>4 $\text{MgCO}_3 \rightarrow \text{MgO} + \text{CO}_2$</p> <p>5 $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{C} + \text{H}_2\text{O}$</p>

p157	<p>1 The chemical property of a substance describes the chemical changes that may occur with the substance.</p> <p>2 A chemical property of hydrogen is that it will react explosively with oxygen.</p> <p>a) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$</p> <p>b) A possible use for hydrogen could thus be as rocket fuel, or in fuel cells.</p> <p>3 <i>Fuel cells</i> change the chemical energy of the reaction between hydrogen and oxygen into electricity. Fuel cells can be used to power engines.</p> <p>4 Iron describes the element (Fe). Steel is iron mixed with small amounts of other elements such as carbon to make the iron harder and stronger. An alloy is a mixture of elements. Steel is an alloy of iron and mainly carbon.</p> <p>5 The rusting of steel is essentially a reaction between iron and oxygen in the air.</p> <p>a) $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$</p> <p>b) The prevention of rusting is helped by: Coating the steel with a material (such as zinc - galvanisation) to prevent oxygen meeting the iron, keeping the iron dry, combine the iron with some other material so that the new material doesn't chemically combine with oxygen.</p>
p158	<p>1 The evidence that rotting fruit is a chemical change is change in colour, change in taste.</p> <p>2 Essentially the ripening of fruit is a chemical change from starch to fructose (a sugar) summarised by: $\text{C}_6\text{H}_{10}\text{O}_5 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6$</p> <p>a) This is a combination reaction?</p> <p>b) Fructose has more hydrogen and oxygen atoms.</p> <p>3 The two factors mostly responsible for the rotting of fruit are the loss of its supply of oxygen, water, and nutrients.</p> <p>4 The breakdown of fructose is an exothermic reaction as microbes use the energy produced by the breakdown.</p>
p159	<p>1 A hydrogen fuel cell uses hydrogen and oxygen to produce an electrical current.</p> <p>2 The net chemical reaction in a hydrogen fuel cell is: $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$</p> <p>a) A combination reaction.</p> <p>b) The product of a hydrogen fuel cell is water.</p> <p>3 Three advantages are: More efficient, no greenhouse emissions, produces energy quietly. Three disadvantages are: expensive, extraction of hydrogen from natural gas produces carbon dioxide, hydrogen isn't readily available.</p>

p162	<p>1 Physical change happens when a substance changes from one form to another form but keeps exactly the same chemical composition.</p> <p>2 Indicate why each of the following are physical changes:</p> <ul style="list-style-type: none"> a) The freezing of water involves the changing from liquid water to solid ice but water keeps exactly the same chemical composition. b) Solid sugar disappears in water when dissolved but the sugar and the water keep exactly the same chemical composition. c) Making lemonade by squeezing lemon juice and adding sugar and water is a physical change because the substances keep exactly the same chemical composition. <p>3 Examples of physical change are: Boiling water, condensation of water, melting ice, moisture forming on the outside of a cold glass, breaking a glass, a limb falling off a tree, cutting paper with a pair of scissors, sharpening a pencil, mashing a potato, evaporating alcohol.</p> <p>4 Chemical change happens when a new substance is formed. Chemical change happens when a substance combines with another substance to form one or more new substances. Chemical change happens when a substance breaks down into two or more substances. Chemical change is not reversible except with further chemical change.</p> <p>5 Indicate why each of the following are chemical changes:</p> <ul style="list-style-type: none"> a) Rusting iron is a chemical change because a new substance is formed by the combination of iron with oxygen: $4\text{Fe} + 3\text{O}_2 + 6\text{H}_2\text{O} \rightarrow 4\text{Fe(OH)}_3$ b) Toasting bread is a chemical change because the change is irreversible. c) A rotting piece of fruit is a chemical change because of change of colour, taste, and smell. d) Tarnishing, browning, of silver is a chemical change because the silver is reacting with oxygen to produce brown oxides. <p>6 Can you think of 10 more examples of chemical change? Making bread, baking a cake, digestion in the small intestine, saliva acting on food, a burning candle, rotting wood, rotting fruit.</p>
p163	<p>1 The following evidence can suggest that a chemical, chemical reaction, has taken place: Change of colour, Change in temperature, Change of smell, Change of form, Production of gases, Production of a precipitate, Decomposition of organic material, Light or sound is produced.</p> <p>2 An exothermic reaction produces heat.</p> <p>3 An endothermic reaction absorb heat.</p> <p>4 The rusting of iron can be summarised by the symbolic equation: $4\text{Fe} + 3\text{O}_2 + 6\text{H}_2\text{O} \rightarrow 4\text{Fe(OH)}_3$</p> <ul style="list-style-type: none"> a) The symbol for iron is Fe b) The evidence that rusting is a chemical change is the formation of a new substance. <p>5 The evidence that the ripening of fruit is a chemical change is a change in colour.</p> <p>6 Smell and taste can be used as evidence of a chemical change. Smell and taste should be avoided because it cab be dangerous.</p> <p>7 A precipitate is the formation of a solid in a solution during a chemical reaction.</p> <p>8 Which of the following is a chemical change and which is a physical change?</p> <ul style="list-style-type: none"> a) Building a sand castle on the beach - physical change. b) Painting a desk green - physical change. c) Lighting a candle - chemical change. d) Cooking biscuits - chemical change. e) Bending/snapping a light stick to produce a glow chemical change. <p>9 The chemical reaction of baking soda and calcium chloride produces a precipitate. The symbolic equation is: $2\text{NaHCO}_3 + \text{CaCl}_2 \rightarrow \text{CaCO}_3 + 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$ The symbolic formula of the precipitate is CaCO_3</p>

p164

- 1 Combination reactions occur when two or more substances combine to form a new substance.
- 2 X and Y are the reactants and XY is the product.
- 3 A lit splint is used for the test of hydrogen: Hydrogen gas burns with a ‘pop’ sound and extinguishes the lit splint.
- 4 Hydrogen will react explosively with oxygen to produce water: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- 5 Combustion is the chemical combination of a substance with oxygen and produces heat.
- 6 $\text{C} + \text{O}_2 \rightarrow \text{CO}_2 + \text{heat}$
- 7 $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO} + \text{heat}$
- 8 $\text{Fe} + \text{S} \rightarrow \text{FeS}$
- 9 $\text{S} + \text{O}_2 \rightarrow \text{SO}_2$
- 10 Decomposition reactions occur when a substance breaks down to form two or more new substances.
- 11 XY is the reactant and X and Y are the products.
- 12 The electrolysis of water decomposes water into hydrogen and oxygen.
 - a) A lit splint is used for the test of hydrogen: Hydrogen gas burns with a ‘pop’ sound and extinguishes the lit splint.
 - b) A glowing splint (no flames burning) is used to test for oxygen. Oxygen gas rekindles the glowing splint as it bursts into flames.
- 13 $\text{MgCO}_3 \rightarrow \text{MgO} + \text{CO}_2$
- 14 $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{C} + \text{H}_2\text{O}$

p165

- 1 The bottom box

7	3	8	18
2	1	4	7
5	9	6	20
14	13	18	

- 2
- 3 Cog A needs an 8 tooth turn to be upright
Cog F needs a 4 tooth turn to be upright
Cog A Tooth turns Cog A Tooth turns
4 4 (upright)
12 12 (upright)
20 (1 rotation+4) 20 (upright)
28 (1 rotation+12) 28 (upright)
36 (2 rotations+4) 36 (upright)
44 (2 rotations+12) 44 (upright)
52 (3 rotations+4) 52 (upright)
60 (3 rotations+12) 60 (upright)

The conclusion is that it is not possible for both to be upright?

p166

- 1 The **chemical property** of a substance describes the **chemical changes** that may occur with the substance.
- 2 A chemical property of hydrogen is that it will react explosively with oxygen.
 - a) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
 - b) A possible use for hydrogen could thus be as rocket fuel, or in fuel cells.
- 3 Iron describes the element (Fe). Steel is iron mixed with small amounts of other elements such as carbon to make the iron harder and stronger. An **alloy** is a mixture of elements. Steel is an alloy of iron and mainly carbon.
- 4 The rusting of steel is essentially a reaction between iron and oxygen in the air.
 - a) $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
 - b) The prevention of rusting is helped by: Coating the steel with a material (such as zinc - galvanisation) to prevent oxygen meeting the iron, keeping the iron dry, combine the iron with some other material so that the new material doesn't chemically combine with oxygen.

p166

- 5 The evidence that rotting fruit is a chemical change is change in colour, change in taste.
- 6 Essentially the ripening of fruit is a chemical change from starch to fructose (a sugar) summarised by:
 $C_6H_{10}O_5 + H_2O \rightarrow C_6H_{12}O_6$
- a) This is a combination reaction?
- b) Fructose has more hydrogen and oxygen atoms.
- 7 The breakdown of fructose is an exothermic reaction as microbes use the energy produced by the breakdown.
- 8 A hydrogen fuel cell uses hydrogen and oxygen to produce an electrical current.
- 9 The net chemical reaction in a hydrogen fuel cell is:
 $H_2 + O_2 \rightarrow H_2O$
- a) A combination reaction.
- b) The product of a hydrogen fuel cell is water.
- 10 Three advantages are: More efficient, no greenhouse emissions, produces energy quietly.
Three disadvantages are: expensive, extraction of hydrogen from natural gas produces carbon dioxide, hydrogen isn't readily available.

p167

- 1 c) 2 b) 3 c) 4 c)

p168

- 1 When sugar and yeast are mixed together, the yeast, a fungus, feeds on the sugar. This is described as fermentation because alcohol and bubbles of carbon dioxide are produced.
Sugar \rightarrow ethanol + carbon dioxide + energy
 $C_6H_{12}O_6 \rightarrow 2CH_3CH_2OH + 2CO_2 + \text{energy}$
- a) Bubbles of gas are produced, and energy is produced.
- b) The feeding of yeast on sugar is a decomposition reaction.
- c) The evidence that fermentation is an exothermic reaction is that energy (heat) is produced.
- 2 a) **A graph of temperature vs height**
-
- | Temperature (°C) | Bubble height (mm) |
|------------------|--------------------|
| 10 | 60 |
| 25 | 100 |
| 40 | 160 |
| 80 | 70 |
- b) The graph suggests that the optimal temperature for the feeding of yeast on sugar is 35°C to 45°C. Temperatures outside this range tend to restrict yeast activity.
- c) The graph suggests that the optimal temperature for the feeding of yeast on sugar is 35°C to 45°C.
- 3 a) The anode is positive.
- b) The battery eventually becomes flat because either the manganese oxide or the carbon is depleted.

- 4 a)

Gas	Formula
Methane	CH_4
Ethane	C_2H_6
Propane	C_3H_8
Butane	C_4H_{10}
Pentane	C_5H_{12}

