Subject: Integrated Science/Chemistry

Level: Form 3

Topic: Reactions of acids

Key points:

- acid + metal ⟶ salt + water (neutralisation reaction)
- acid + metal ⟶ salt + hydrogen gas
- acid + carbonate ⟶ salt + carbon dioxide + water
- The name of the salt produced in any of the above reactions is based on the acid used in the reaction.
- Salts have a first and last name. The first name comes from the metal and the last name comes from the acid. See the table below:

ACID NAME	NAME OF SALT PRODUCED
Hydrochloric acid	chloride
Sulphuric acid	sulphate
Nitric acid	nitrate
Phosphoric acid	phosphate

- Neutralisation reactions, as shown above, can solve many of our everyday problems.

PROBLEM	SOLUTION
Indigestion	Use of antacid tablets
Bee sting	Use lotion with alkaline active ingredient
Acid soil	Use lime (calcium oxide) or slaked lime (calcium hydroxide)
Baking	Use sodium bicarbonate

Activity:

1. Which acid is needed to produce the following salts?

   A. Copper nitrate _____
   B. Magnesium chloride _____
   C. Sodium sulphate _____
   D. Potassium phosphate _____

2. There are three ways of producing salts with acids. Complete the following word equations to illustrate them.

   A. Acid + metal ⟶ salt + _____
   B. Acid + _____ ⟶ salt + water
   C. Acid + carbonate ⟶ salt + _____ + water

3. Complete the following reactions by filling the blanks.

   A. Sodium hydroxide + sulphuric acid ⟶ _____ + water
   B. _____+ hydrochloric acid ⟶ magnesium chloride + carbon dioxide + water
   C. Zinc + _____ ⟶ zinc nitrate + hydrogen

Assessment:

1. Complete the following equations by filling in the products

   A. Copper carbonate + nitric acid ⟶ _____ + _____ + _____
   B. Magnesium + sulphuric acid ⟶ _____ + _____
   C. Calcium hydroxide + hydrochloric acid ⟶ _____ + _____
   D. Sodium hydroxide + phosphoric acid ⟶ _____+ _____

2. The table below shows a variety of everyday problems related to acids and alkalis.
   a) Colour each everyday problem green if it is caused by an acid or yellow if it is caused by an alkali (some research is required).
   b) Choose the best remedy for each problem from the list in the box.

Vinegar	antacid	lime	bicarbonate of soda	toothpaste

EVERYDAY PROBLEM	**REMEDY**	**SUGGESTED EXPLANATION**
Wasp sting venom is slightly alkaline		
Bee sting venom is pH 5.5		
The plaque that forms on teeth contains bacteria that break down sugary foods, but at the same time produces acid that attack the tooth surface.		
Heartburn is a type of indigestion caused by hydrochloric acid in the stomach		
Soil that has a pH below 6 will stunt plant growth		
Baking products tend to be heavy when an ingredient is missing		

Answer key:

Activity

1. A) nitric acid

   B) Hydrochloric acid

   C) Sulphuric acid

   D) Phosphoric acid

2. A) hydrogen gas

   B) alkali

   C) carbon dioxide

3. A) sodium sulphate

   B) magnesium carbonate

   C) nitric acid

Assessment

1.

A. Copper carbonate + nitric acid ⟶ copper nitrate + carbon dioxide + water
B. Magnesium + sulphuric acid ⟶ magnesium sulphate + hydrogen
C. Calcium hydroxide + hydrochloric acid ⟶ calcium chloride + water
D. Sodium hydroxide + phosphoric acid ⟶ sodium phosphate + water

2.

EVERYDAY PROBLEM	REMEDY	SUGGESTED EXPLANATION
Wasp sting venom is slightly alkaline	vinegar	The vinegar is acidic and neutralises the alkaline venom
Bee sting venom is pH 5.5	Bicarbonate of soda	pH 5.5 is acidic , the bicarbonate of soda is alkaline, so an acid/base reaction occurs neutralising the acid in the venom
The plaque that forms on teeth contains bacteria that break down sugary foods, but at the same time produces acid that attack the tooth surface.	toothpaste	The bicarbonate of soda in the toothpaste, which is alkaline reacts with the acid produces by the bacteria when they breakdown sugary food to neutralise it.
Heartburn is a type of indigestion caused by hydrochloric acid.	antacid	The antacid which is alkaline reacts with the acid in the stomach, which is acidic, neutralising it.
Soil that has a pH below 6 will stunt plant growth	lime	The calcium oxide (lime), which is alkaline, reacts with the acidic soil neutralising it.
Baking products tend to be heavy when an ingredient is missing	Bicarbonate of soda	The bicarbonate of soda which is alkaline reacts with the milk to produce carbon dioxide gas. This gas when trapped in the dough causes it to rise and makes the baked product light.