

# C1.10 Indigestion



This lesson explains why the stomach produces acid and how antacids are used to neutralise the excess acid that causes indigestion.

## Specification coverage

**3.1** Recall that hydrochloric acid is produced in the stomach in order to: a) help digestion b) kill bacteria.

**3.2** Describe indigestion remedies as containing substances that neutralise excess stomach acid.

**0.1** Recall the formulae of elements and simple compounds in the unit.

**0.2** Represent chemical reactions by word equations **H** and simple balanced equations.

**H 0.3** Write balanced equations including the use of state symbols (s), (l), (g) and (aq) for a wide range of reactions in this unit.

**HSW 12** The use of contemporary science and technological developments and their benefits, drawbacks and risks.

The tasks in this lesson also give opportunities to cover **HSW 1, 5, 6, 7, 8** and **10**.

## Key terms

- alkali
- antacid
- base
- digest
- indicator
- litmus paper
- pH scale
- salt
- universal indicator

## Acids and alkalis brainstorm Starter 1

Ask students to write down as many facts about acids, alkalis and neutralisation as they can. Students should do the first part individually for a couple of minutes and then work in small groups to organise their ideas in a more systematic way (e.g. as lists of acidic or alkaline substances, or how to tell if a substance is an acid or an alkali). A spokesperson for each group should then share with the class how their group has organised the information and what information they know.

## Indicator rainbow Starter 2 **Prac / Demo**

This demonstration shows the different colours made by universal indicator, and can be used to remind students of Key Stage 3 work on indicators and the pH scale. See the Teacher and technician practical sheet on page 72 for full details. There are also some YouTube videos showing similar demonstrations that can be used instead of a practical demonstration.

## C1.10a How much acid?

**Exploring 1 **Prac****  
Show students how to use a burette, and ask them to find out how much acid is needed to neutralise a given volume of alkali. This is a very simple titration, although titrations will not be required in the Core Practical next lesson. See Practical sheet C1.10a and the Teacher and technician practical sheet on page 74 for full details.



## Testing tablets Exploring 3

Ask students to imagine that they are working for a consumer organisation, and they have been asked to compare different indigestion remedies and to recommend best buys. Ask them to work in small groups to draw up a plan for testing different remedies. Tell students that there should be two aspects to their plans - finding out how much active ingredient is in each tablet, and finding out whether people prefer the taste/appearance of some tablets over others.

## What's in a tablet? Exploring 2

Provide students with ingredients lists from different antacid indigestion remedies, and ask them to discuss the purpose of the different ingredients. The AB/AT document What's in a tablet? shows the ingredients from two different brands of tablets, and some questions to help students to think about the purpose of the different ingredients.

## Student Book spread C1.10 Explaining 1

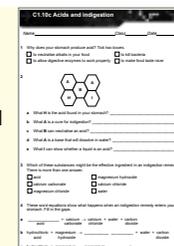
Skills sheet 1 may help with balancing equations. **Working towards A\*** Ask students to write the balanced equation for the reaction of sodium hydrogencarbonate with stomach acid. **Working towards E** Show students the mnemonic for universal indicator colours: reD for in aciD; Blue for Base.

## Sentence starters Plenary 1 **Lit Afl**

Ask students to complete starter sentences using connecting words such as 'and', 'because', 'but', 'however', 'so', 'such as', 'therefore', 'to', 'which'. They should be encouraged to complete each sentence in more than one way, using a different connecting word each time. Suitable sentences include 'the stomach produces acid ...'; 'antacids are used to treat indigestion ...'; 'an alkali is a base ...';

## C1.10c Acids and indigestion Homework 1

C1.10c is designed for students needing support and provides questions on the content of this lesson. **Working towards E** Go over the key words and word equations in the Student Book before students take the worksheet home.



## C1.10b Formulae and equations Plenary 2 **Afl**

Worksheet C1.10b provides a set of cards for students to match the names of compounds in this lesson to complete word equations.



## C1.10d Natural remedies Homework 2

Worksheet C1.10d is designed for more able students and provides questions asking students to apply their knowledge to assess the likely effectiveness of various natural 'cures' for indigestion. **Working towards A\*** Students answer the Extra challenge question.



# C1.10 Indigestion

## How do indigestion remedies work?

Traditional Chinese medicine uses powdered pearls to cure many things, including indigestion. Pearls are mostly made from calcium carbonate, and this substance helps to neutralise the extra acid that causes indigestion.



A Pearls grow inside oysters.

- 1 Write down two reasons why your stomach produces acid.
- 2 What causes indigestion?
- 3 What is an 'antacid'?

### Looking after your stomach

Your stomach is a key part of your digestive system. It produces hydrochloric acid (HCl), which kills bacteria that may be on your food. Food in the stomach is **digested** (broken down) by digestive enzymes that need acidic conditions to work properly.



C Different indigestion remedies

Sometimes the stomach produces too much acid and this can cause the stomach pain we call indigestion. Sometimes the acid can escape from the top of the stomach, which causes pain in the tube leading to the mouth. This is known as heartburn, although it has nothing to do with the heart.

Medicines called **antacids** can neutralise excess stomach acid. Antacids contain **bases** – substances that can react with acids. Figure B shows some common bases that are used in antacids.

compound	formula
calcium carbonate	CaCO <sub>3</sub>
magnesium carbonate	MgCO <sub>3</sub>
sodium hydrogencarbonate (sodium bicarbonate)	NaHCO <sub>3</sub>
magnesium hydroxide	Mg(OH) <sub>2</sub>
aluminium hydroxide	Al(OH) <sub>3</sub>

B Some antacid compounds

The neutralisation reaction between an acid and a base produces water and a compound called a **salt**. This can be shown by the general equation:

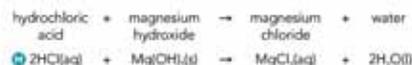


Some bases are soluble. A base dissolved in water is called an **alkali**.

**Remember Plus Watch Out!**

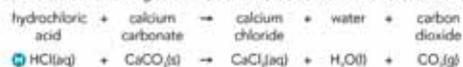
The general equation applies to all reactions between acids and bases, but if a question is asking about stomach acid, the acid will always be hydrochloric acid.

If an indigestion tablet contains magnesium hydroxide, the neutralisation reaction is:

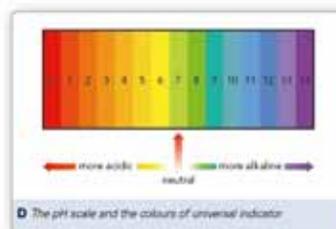


However, if the antacid contains a carbonate, carbon dioxide is also produced: acid + carbonate → salt + water + carbon dioxide

So for a tablet containing calcium carbonate, the neutralisation reaction will be:



We can describe acids and alkalis using the **pH scale**. A neutral liquid (such as water) has a pH of 7. The range of pH values of acids and alkalis is shown in Figure D.



D The pH scale and the colours of universal indicator

We can find out if a liquid is acid or an alkali using an **indicator**. Figure D shows the colours of **universal indicator** at each point on the pH scale. **Litmus paper** is also an indicator. Blue litmus paper turns red under acid conditions, and red litmus paper turns blue under alkaline conditions.

- 7 Write balanced equations for the reactions in question 6. Some of the formulae you need are Al(OH)<sub>3</sub>, AlCl<sub>3</sub>, MgCO<sub>3</sub>, MgCl<sub>2</sub>.
- 8 Write a short paragraph to explain what causes indigestion and how it is cured.

**Skills spotlight**

Scientific developments have benefits and drawbacks. Shells, as well as pearls, contain calcium carbonate. What are the benefits and drawbacks of buying manufactured indigestion tablets rather than just crushing up some seashells if you have indigestion?

- 4 Sodium hydroxide is an alkali. Is sodium hydroxide soluble? Explain your answer.
- 5 Stomach acid would turn universal indicator orange. What is its pH?
- 6 Write word equations for the reactions between hydrochloric acid and:
  - a aluminium hydroxide
  - b magnesium carbonate

### Learning outcomes

- 2.1 Recall that hydrochloric acid is produced in the stomach in order to:
    - a help digestion
    - b kill bacteria
  - 2.2 Describe indigestion remedies as containing substances that neutralise excess stomach acid.
- 12** Describe the benefits, drawbacks and risks of using new scientific and technological developments

Can we make gold from rubbish?

## Answers | Student book

- 1 To kill bacteria; to help with digestion
- 2 Too much acid in the stomach
- 3 A compound that can neutralise acids
- 4 Yes; alkalis are soluble bases
- 5 pH 2

- 6 **a** hydrochloric acid + aluminium hydroxide → aluminium chloride + water  
**b** hydrochloric acid + magnesium carbonate → magnesium chloride + water + carbon dioxide

- 7 **a** 3HCl(aq) + Al(OH)<sub>3</sub>(s) → AlCl<sub>3</sub>(aq) + 3H<sub>2</sub>O(l)  
**b** 2HCl(aq) + MgCO<sub>3</sub>(s) → MgCl<sub>2</sub>(aq) + H<sub>2</sub>O(l) + CO<sub>2</sub>(g)
- 8 A good answer will include: **a** the stomach produces acid which kills bacteria and helps to digest food

- b** if too much acid is produced it causes the pain that we call indigestion
- c** indigestion can be cured by neutralising this acid
- d** antacids contain bases such as calcium carbonate that neutralise the acid

### Skills Spotlight

If you live near the sea, shells may be cheaper. Shells contain substances other than calcium carbonate, which may be harmful. Manufactured remedies must be tested for toxicity before they can be sold.

Students may also comment on the difficulty of knowing how much to take (compared to a recommended dose for manufactured remedies, based on the measured quantity of active ingredient) or of grinding up shells so there are no sharp edges that might damage the throat or gullet.