

A Guide to Acids and Bases

Teaching Approach

In this series we focus on practical chemistry and show a number of interesting chemical reactions. From these practical investigations we build our knowledge about the reactions between acids and bases and define what a salt is. We have used animations to show the link between what we observe taking place in a reaction to what is happening at a microscopic level.

Learners should be able to apply what they have learnt by representing the chemical changes they have seen by writing a general word equation. We show how a general equation can be used to write a word equation for a specific reaction and how to translate the word equation into a balanced chemical equation using symbols. This important skill, which was also examined in Grade 10 needs to be revised and practised as often as possible.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given.

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch or show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next day's lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson.

1. Overview of Acids and Bases

The first lesson introduces learners to the focus of this series: acids and bases. It also establishes important differences between these two kinds of substances.

2. Acid-base Theories and Conjugate Acid-base Pairs

This lesson focuses on the different acid-base theories as well as conjugate acid-base pairs.

3. Indicators

In this lesson we find out that chemical indicators can be used to distinguish if a substance is an acid or a base or if it is neutral. Chemical indicators can be found in the lab or they can be produced from natural substances, such as plants.

4. Reactions of Acids and Bases

This lesson investigates the reaction between an acid and an alkali. A basic neutralisation reaction is performed using sodium hydroxide and hydrochloric acid with an indicator.

5. Preparation of Salts

This lesson has a look at three ways to prepare salts:

- Acid + alkali
- Acid + metal oxide
- Acid + carbonate

Resource Material

| | | |
|------------------------------------|---|--|
| 1. General | http://phet.colorado.edu/en/simulation/acid-base-solutions | Fun, interactive, research-based simulations of acid-base solutions. |
| 2. Introduction to Acids and Bases | http://www.elmhurst.edu/~chm/vchembook/180acidsbases.html | This page introduces and defines acids and bases. |
| | http://www.sparknotes.com/chemistry/acidsbases/intro/summary.html | This page provides an introduction to acids and bases. |
| 3. Indicators | http://www.chem4kids.com/files/react_acidbase.html | Basic information on acids and bases. |
| | http://www.chemguide.co.uk/physical/acidbaseeqia/theories.html | This page describes the Arrhenius, Bronsted-Lowry, and Lewis theories of acids and bases, and explains the relationships between them. |
| | http://www.kentchemistry.com/links/AcidsBases/AcidBaseTheories.htm | This page looks at all the different theories of acids and bases. |
| 4. Acid-Base Reactions | http://phet.colorado.edu/en/simulation/ph-scale | Fun, interactive, research-based simulations of the pH scale. |
| | http://www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/acids_bases_metals/revision/4/ | This page looks at indicators and the pH scale. |
| | http://www.elmhurst.edu/~chm/vchembook/184ph.html | This page introduces and defines the pH scale. |
| 5. Salt Preparation | http://www.docbrown.info/page03/AcidsBasesSalts06.htm | Revision notes on the pH scale of acidity and alkalinity, acids, alkalis, salts and neutralisation. |
| | http://www.chemistryrules.me.uk/middle/salts.htm | This page looks at the preparation of salts. |

Task

Question 1

How do acids and bases differ in

- 1.1 How they feel?
- 1.2 How they taste?

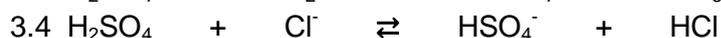
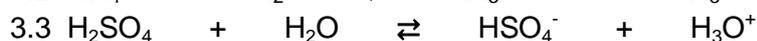
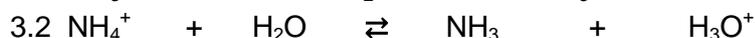
Question 2

Give the definition of an acid and a base according to:

- 2.1 Arrhenius' theory
- 2.2 The Brønsted - Lowry theory

Question 3

Identify the conjugate acid-base pairs in the following reactions:



Question 4

What is the purpose of a chemical indicator?

Question 5

Where on the pH scale would you find:

- 5.1 Acids?
- 5.2 Bases?
- 5.3 Neutral substances?

Question 6

Copy and complete the following table:

| Indicator | Colour in acid | Colour in base |
|------------------|----------------|----------------|
| Bromothymol blue | | |
| Methyl orange | | |
| Phenolphthalein | | |

Question 7

Give a balanced equation for the reaction between:

- 7.1 Hydrochloric acid and sodium hydroxide
- 7.2 Nitric acid and magnesium hydroxide
- 7.3 Acetic acid (CH_3COOH) and potassium hydroxide

Question 8

Give a balanced equation for the reaction between:

- 8.1 Nitric acid + calcium carbonate
- 8.2 Sulfuric acid + sodium carbonate
- 8.3 Hydrochloric acid + magnesium hydroxide

- 8.4 Sulfuric acid + magnesium carbonate
- 8.5 Nitric acid + calcium hydroxide
- 8.6 Sulfuric acid + sodium carbonate
- 8.7 Hydrochloric acid + potassium oxide

Question 9

In each case give an acid-base reaction equation that could be used to produce:

- 9.1 KCl
- 9.2 $\text{Mg}(\text{NO}_3)_2$
- 9.3 CaSO_4

Task Answers

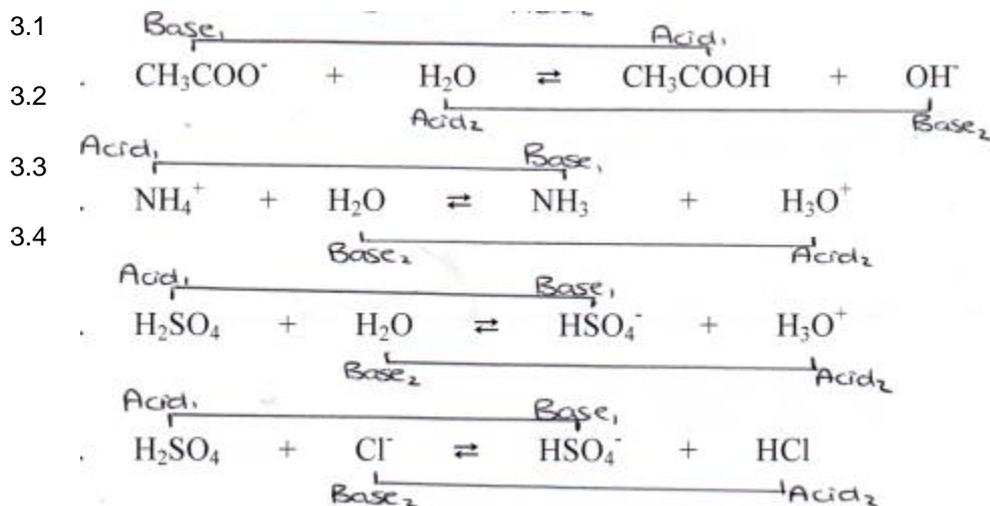
Question 1

- 1.1 Acids feel squeaky and bases have a slimy, soapy feel.
 1.2 Acids taste sharp and sour. Bases taste bitter.

Question 2

- 2.1 Arrhenius' theory:
- **Acids** are substances that ionise in solution to produce H^+ ions (and ultimately H_3O^+ ions).
 - **Bases** are substances that dissociate in solution to produce OH^- ions.
- 2.2 Brønsted - Lowry theory:
- **Acids** are proton donors.
 - **Bases** are proton acceptors.

Question 3



Question 4

The purpose of an indicator is to identify whether a substance can be classified as an acid or a base.

Question 5

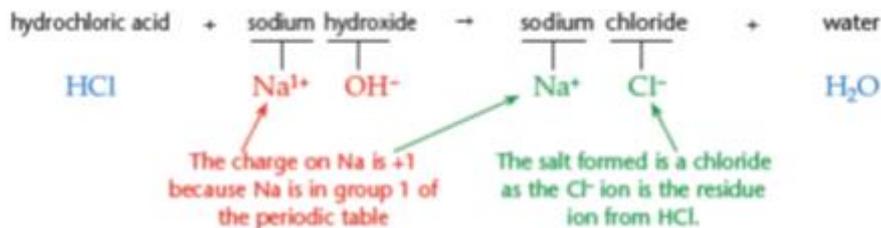
- 5.1 pH less than 7
 5.2 pH greater than 7
 5.3 pH of 7

Question 6

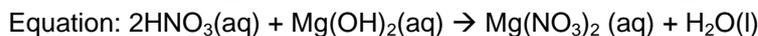
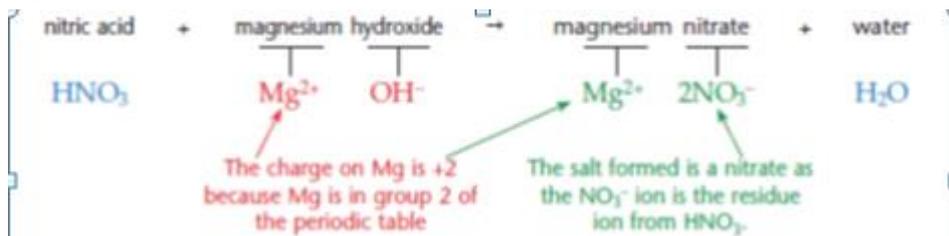
| Indicator | Colour in acid | Colour in base |
|------------------|----------------|----------------|
| Bromothymol blue | Yellow | Blue |
| Methyl orange | Red | Yellow |
| Phenolphthalein | Colourless | Pink |

Question 7

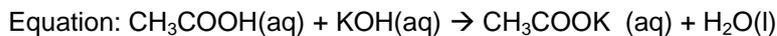
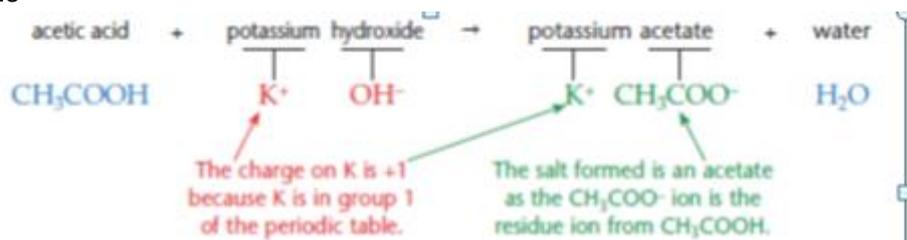
7.1



7.2

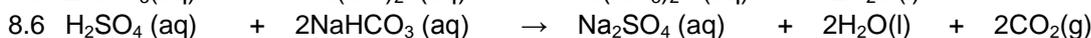
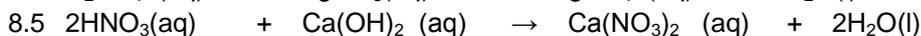
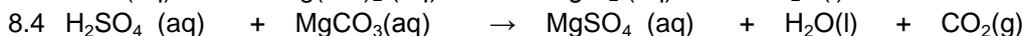
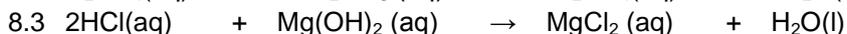
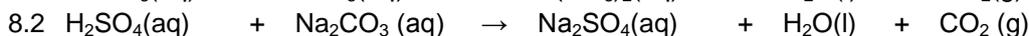


7.3

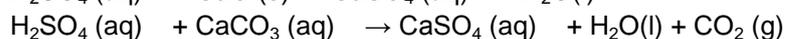
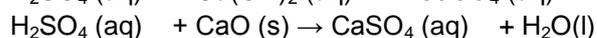
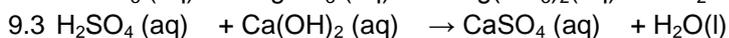
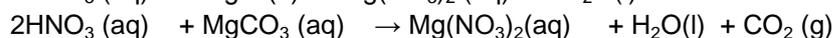
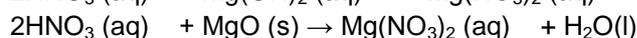
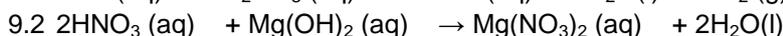
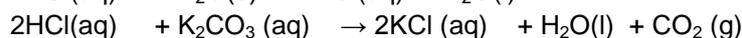
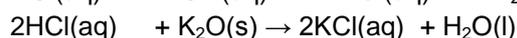
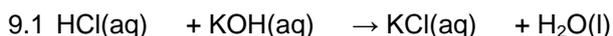


Metal is put after the acetate in the formula.

Question 8



Question 9



Acknowledgements

| | |
|---|-------------------|
| Mindset Learn Executive Head | Dylan Busa |
| Content Manager Classroom Resources | Jenny Lamont |
| Content Coordinator Classroom Resources | Helen Robertson |
| Content Administrator | Agness Munthali |
| Content Developer | Christine McLaren |
| Content Reviewers | Bruce Nozaic |
| | Liz Harris |

Produced for Mindset Learn by Traffic

| | |
|------------------------|--------------------|
| Facilities Coordinator | Cezanne Scheepers |
| Production Manager | Belinda Renney |
| Director | Alriette Gibbs |
| Editor | Nonhlanhla Nxumalo |
| | Talent Maphisa |
| Presenter | Banji Longwe |
| Studio Crew | Abram Tjale |
| | James Tselapedi |
| | Wilson Mthembu |
| Graphics | Wayne Sanderson |

Credits

http://upload.wikimedia.org/wikipedia/commons/6/63/Green_soup_at_the_swimming_pool_-_geograph.org.uk_-_1254766.jpg

http://upload.wikimedia.org/wikipedia/commons/e/e1/Swimming_pool_large.jpg

<http://upload.wikimedia.org/wikipedia/commons/1/1b/Arrhenius.jpg>

http://en.wikipedia.org/wiki/File:Thomas_Martin_Lowry2.jpg

http://upload.wikimedia.org/wikipedia/commons/2/24/Johannes_Brønsted.jpg

<http://www.fotopedia.com/items/carolsanzeux-ac79ac56c90561f89e6320c3794732fe>

<http://www.fotopedia.com/items/flickr-243279412>

http://www.excellup.com/classten/scienceten/AcidBaseSalt_image/10_science_acid_ph_colour_chart.png

http://upload.wikimedia.org/wikipedia/commons/b/b6/Sulphuric_acid_96_percent_extra_pure.jpg



This resource is licensed under a [Attribution-Share Alike 2.5 South Africa](http://creativecommons.org/licenses/by-sa/2.5/za/) licence. When using this resource please attribute Mindset as indicated at <http://www.mindset.co.za/creativecommons>