

GCSE Combined Science: Trilogy

Worksheet: The pH scale and neutralisation

TIME 30 min	TOTAL 29 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: The pH scale and neutralisation

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The pH scale measures how acidic or alkaline a solution is.

0 1 . 1

State the range of values on the pH scale.

[1 mark]

0 1 . 2

Universal indicator turns orange when added to a solution.

Which pH range does this indicate?

Tick (✓) **one** box.

pH 1–2 (strongly acidic)

☐

pH 4–5 (weakly acidic)

☐

pH 8–9 (weakly alkaline)

☐

pH 13–14 (strongly alkaline)

☐

[1 mark]

0 2

The pH scale is a measure of the acidity or alkalinity of a solution.

0 2 . 1

What is the pH of a neutral solution?

.....

.....

.....

.....

[1 mark]

0 2 . 2

Which pH value shows a strongly acidic solution?

Tick (✓) **one** box.

pH 1

☐

pH 6

☐

pH 8

☐

pH 13

☐

[1 mark]

0 2 . 3

Name the ions that acids produce in aqueous solution.

.....

.....

.....

.....

[1 mark]

0 2 . 4

Name the ions present in all aqueous solutions of alkalis.

.....

.....

.....

.....

[1 mark]

0 3

Universal indicator changes colour depending on the pH of a solution.

0 3 . 1

What colour is universal indicator in a neutral solution?

.....

.....

.....

.....

[1 mark]

0 3 . 2

Sodium hydroxide solution turns universal indicator purple.
Suggest the pH of the sodium hydroxide solution.

.....

.....

.....

.....

[1 mark]

0 3 . 3

Which could be the pH of lemon juice?

Tick (✓) **one** box.

pH 2

☐

pH 7

☐

pH 9

☐

pH 12

☐

[1 mark]

0 3 . 4

An acid neutralises an alkali to produce a salt and one other product.
Name the other product.

.....

.....

.....

.....

[1 mark]

0 4

Table 1 shows the approximate colour of universal indicator at different pH values.

Table 1

pH	Colour
1–3	red
4–6	orange/yellow
7	green
8–10	blue
11–14	purple

0 4 . 1

A student adds universal indicator to a solution and it turns blue.
Estimate the pH of the solution.

.....

.....

[1 mark]

0 4 . 2

A different solution has a pH of 2.
Predict the colour of universal indicator in this solution.

.....

.....

[1 mark]

0 4 . 3

Explain why universal indicator, rather than a single-colour indicator such as litmus, is used to estimate the approximate pH of a solution.

.....

.....

.....

.....

[2 marks]

0 5

A gardener wants to find the approximate pH of a soil sample.

0 5 . 1

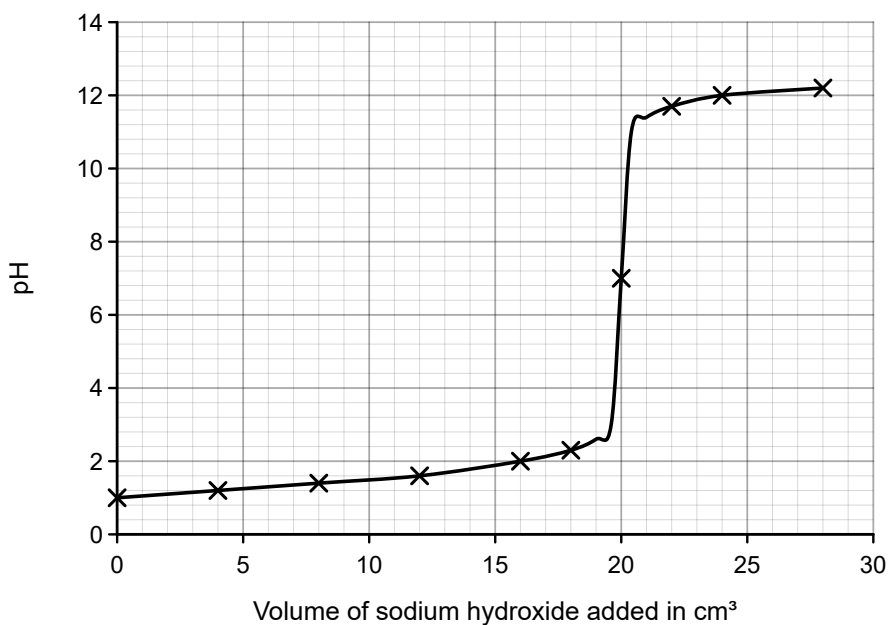
Describe how the gardener could use universal indicator to estimate the soil's pH.

[2 marks]

0 6

A student added sodium hydroxide solution to 20 cm^3 of dilute hydrochloric acid. The student used a pH probe to measure the pH after each addition. Figure 1 shows the results.

Figure 1



0 6 . 1

What volume of sodium hydroxide solution neutralised the acid?

.....

.....

.....

Volume = cm^3

[1 mark]

0 6 . 2

Describe how the pH changes as the sodium hydroxide solution is added.

.....

.....

.....

.....

.....

.....

[3 marks]

0 6 . 3

Explain why the pH increases as sodium hydroxide solution is added to the acid. Use ideas about ions in your answer.

[2 marks]

0 7

A student is choosing an indicator for two different tasks: (1) estimating the approximate pH of a sample of rainwater, and (2) detecting the exact end point of an acid–alkali neutralisation titration.

0 7 . 1

Explain which type of indicator is more suitable for each task.

[2 marks]

0 8

In neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions.

0 8 . 1

Write the ionic equation, including state symbols, for the reaction between hydrogen ions and hydroxide ions.

[2 marks]

0 8 . 2

Describe how a student could use universal indicator to find the approximate pH of a solution.

.....

.....

.....

.....

[2 marks]

0 8 . 3

Give **one** advantage of using a pH probe instead of universal indicator.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: The pH scale and neutralisation · 29 marks

Question 1 (2 marks)

01.1 [1 mark]

Answer: 0 to 14

- 0 to 14 (1)
-

01.2 [1 mark]

Correct: pH 4–5 (weakly acidic)

Question 2 (4 marks)

02.1 [1 mark]

Answer: 7

- 7 (1)
-

02.2 [1 mark]

Correct: pH 1

02.3 [1 mark]

Answer: hydrogen ions, H^+

- hydrogen ions / H^+ (1)

Notes: Do not accept 'hydrogen' or 'hydrogen atoms'.

02.4 [1 mark]

Answer: hydroxide ions, OH^-

- hydroxide ions / OH^- (1)
-

Question 3 (4 marks)

03.1 [1 mark]

Answer: green

- green (1)

03.2 [1 mark]

Answer: 13 (allow 12–14)

- any value from 12 to 14 (1)

03.3 [1 mark]

Correct: pH 2

03.4 [1 mark]

Answer: water

- water (1)
-

Question 4 (4 marks)

04.1 [1 mark]

Answer: 8–10

- 8–10 (any value in this range) (1)

04.2 [1 mark]

Answer: red

- red (1)

04.3 [2 marks]

- universal indicator turns a range of different colours across the whole pH scale, allowing an approximate pH value to be estimated (1)
 - a single-colour indicator such as litmus only shows whether a solution is acidic or alkaline, not its approximate pH value (1)
-

Question 5 (2 marks)

05.1 [2 marks]

- mix a sample of the soil with distilled water, then allow it to settle (or filter) to get a clear liquid (1)
 - add a few drops of universal indicator to the clear liquid and compare the colour produced with a pH colour chart (1)
-

Question 6 (6 marks)

06.1 [1 mark]

Answer: 20 cm³

- 20 (cm³) (1)

06.2 [3 marks]

- the pH starts low (about 1) and increases slowly at first (1)
- the pH rises sharply / suddenly (from about 3 to about 11) at about 20 cm³ (1)
- then the pH increases slowly / levels off at about 12 (1)

Notes: Allow correct values read from the graph.

06.3 [2 marks]

- hydroxide ions (from the alkali) react with hydrogen ions (to form water) (1)
- so the concentration of hydrogen ions decreases (1)

Question 7 (2 marks)

07.1 [2 marks]

- universal indicator is more suitable for estimating the approximate pH of rainwater, because it shows a range of different colours corresponding to different pH values (1)
 - an indicator with a single sharp colour change (such as phenolphthalein) is more suitable for a titration, because the end point is easy to see, rather than a gradual change through several colours (1)
-

Question 8 (5 marks)

08.1 [2 marks]

Answer: $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$

- $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ (1)
 - state symbols (aq), (aq), (l) (1)
-

08.2 [2 marks]

- add a few drops of universal indicator to a sample of the solution / dip universal indicator paper into it (1)
 - compare the colour with a pH colour chart (1)
-

08.3 [1 mark]

- gives a more precise / accurate (numerical) value / does not depend on judging a colour / works with coloured solutions / can take continuous readings (1)
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