

GCSE Chemistry (9 – 1)

pH Graphs

Name:

Group:.....

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/4
2	/4
3	/6
4	/7
5	/12
Total	/33
%	
Grade	

Information

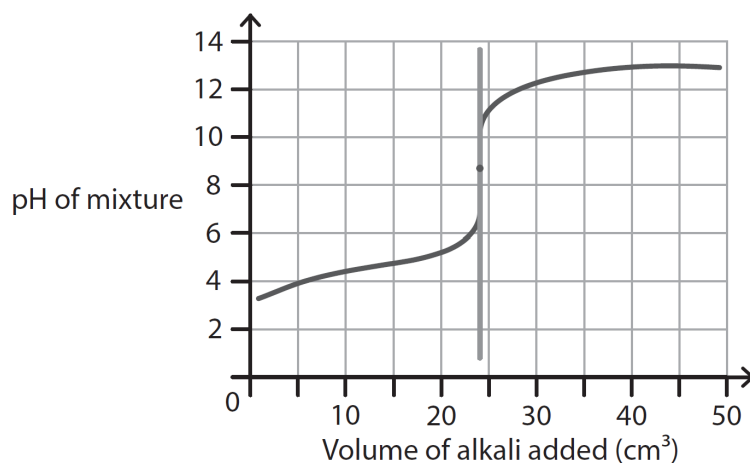
- The maximum mark for this paper is 33 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. A pH curve is a graph that shows how the pH of a solution changes during a neutralisation reaction.

Circle the letter of the correct answer for each of the following questions.

a. The graph below shows the change in pH when a strong alkali is added to an acid.

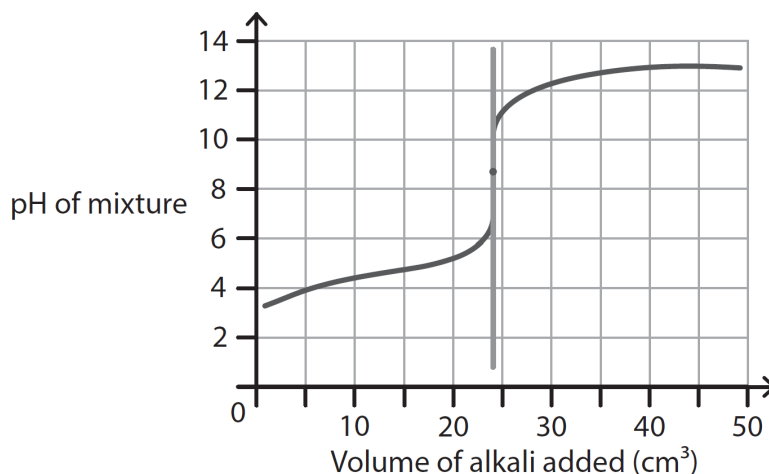


Which statement correctly describes the reactants?

- A** A strong acid being neutralised by a strong alkali.
- B** A weak acid being neutralised by a strong alkali.
- C** A strong alkali being neutralised by a strong acid.
- D** A weak acid being neutralised by a weak alkali.

(1 mark)

b. The graph below shows the pH curve for the titration of 25.0 cm³ of a strong acid with a strong alkali.



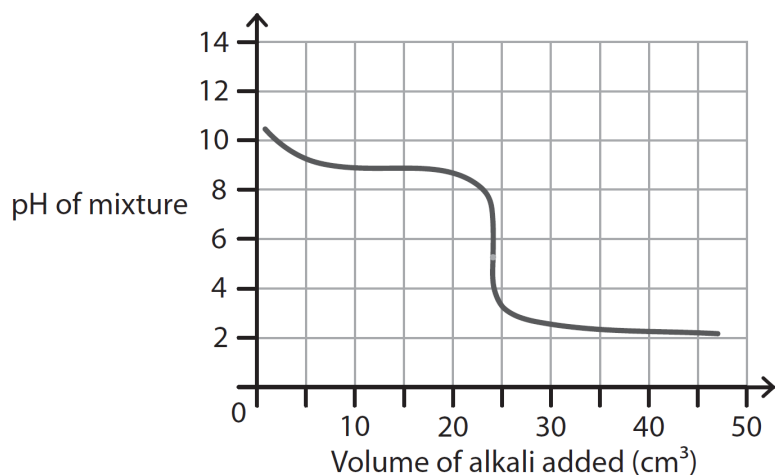
What is the volume of alkali needed to exactly neutralise the acid?

- | | | | |
|---------------------|----------------------|----------------------|----------------------|
| A | B | C | D |
| 7.0 cm ³ | 20.0 cm ³ | 25.0 cm ³ | 50.0 cm ³ |

(1 mark)

- c. The graph below shows the results of a different titration.

A student needs to select a suitable indicator for this titration. The table shows the pH range for three common indicators.



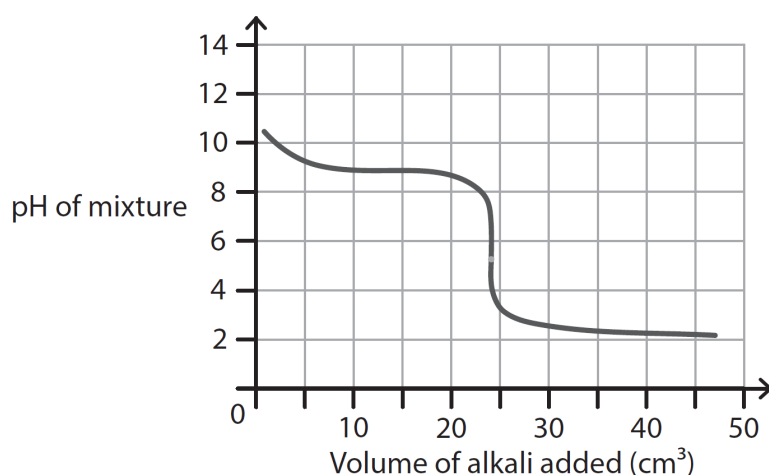
Indicator	pH range of colour change
Methyl orange	3.1 – 4.4
Phenolphthalein	8.3 – 10.0
Universal indicator	1 – 14

Which indicator should the student use?

- | | | | |
|---------------|-----------------|--------------|---------------------|
| A | B | C | D |
| Methyl orange | Phenolphthalein | Litmus paper | Universal indicator |
- (1 mark)**

- d. A student carries out the titration shown in the graph below.

They add 0.20 mol/dm³ sodium hydroxide (NaOH) to 25.0 cm³ of hydrochloric acid (HCl).



What is the concentration of the hydrochloric acid?

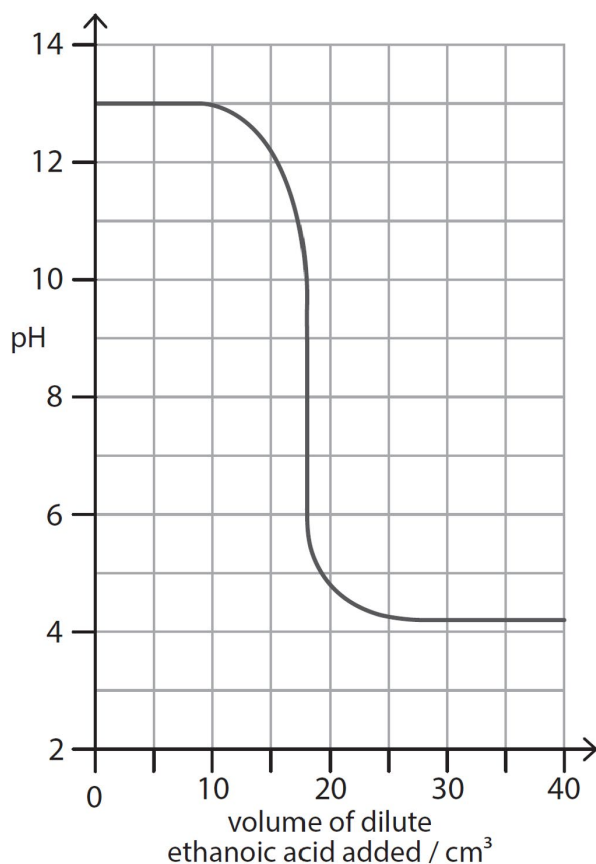
- | | | | |
|--------------------------|--------------------------|------------------------|------------------------|
| A | B | C | D |
| 0.10 mol/dm ³ | 0.20 mol/dm ³ | 40 mol/dm ³ | 50 mol/dm ³ |

(1 mark)

(Total for Question 1 is 4 marks)

2. This question is about pH graphs.

The graph shows how the pH changes when dilute ethanoic acid is added slowly to a solution of sodium hydroxide.



a. Determine the pH of the aqueous sodium hydroxide **before** the addition of dilute ethanoic acid.

pH of NaOH = ...
(1 mark)

b. Deduce the volume of dilute ethanoic acid added when the pH is neutral.

..... cm³
(1 mark)

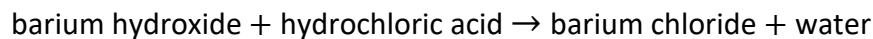
c. Sodium hydroxide, NaOH, is a strong alkali.
Explain what is meant by a strong alkali?

.....
.....
.....
.....
(2 marks)

(Total for Question 2 is 4 marks)

3. Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride and water.

The word equation for this reaction is:



- a. Write the balanced chemical equation for this reaction.

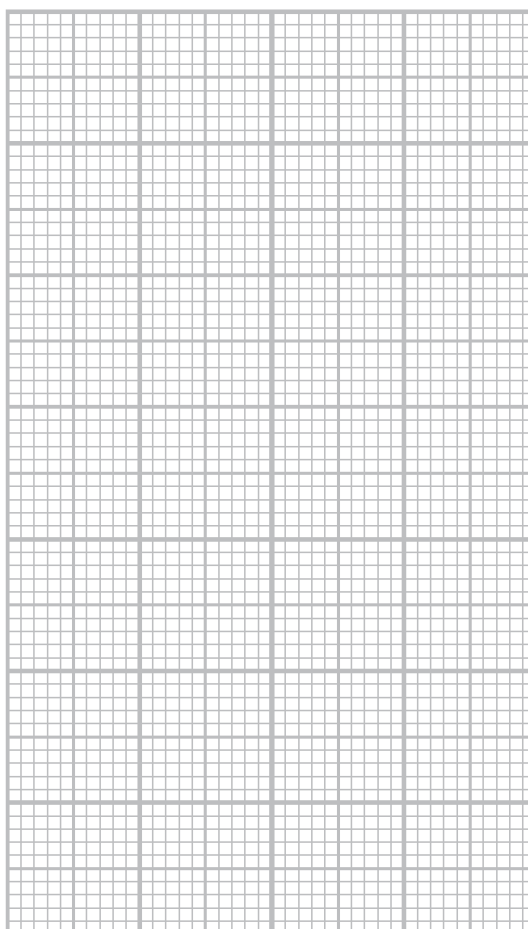
.....
(3 marks)

A student wanted to investigate how the pH of the mixture changes as barium hydroxide is added to dilute hydrochloric acid. The table below shows the students results.

Mass of barium hydroxide in g	pH of mixture
0.0	1
0.5	1
1.0	1
1.5	2
2.0	7
2.5	12
3.0	13
3.5	13

- b. On the grid below:

- Include a suitable scale to the x and y axes of the graph.
- Plot a graph of the pH of the mixture against the mass of barium hydroxide.

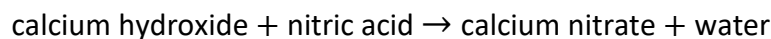


(3 marks)

(Total for Question 3 is 6 marks)

4. A student investigates the neutralisation reaction between an acid and an alkali.
The student adds hydrochloric acid to a beaker containing calcium hydroxide solution.

The word equation for this reaction is:



- a. Write the balanced chemical equation for this reaction.

.....
(3 marks)

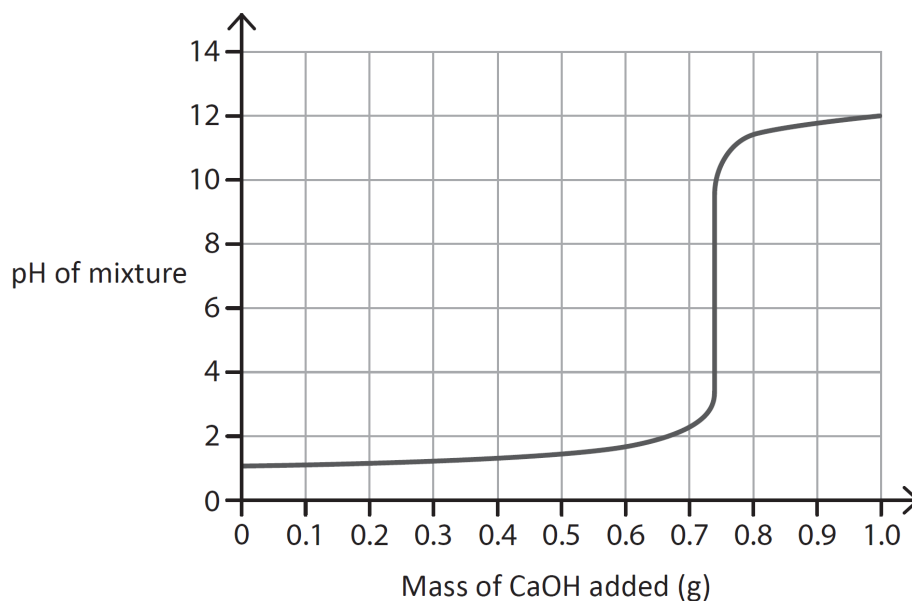
- b. A student plans to investigate the change in pH when calcium hydroxide solution is added to dilute hydrochloric acid.

She will add the calcium hydroxide 0.1 g at a time and measure the pH after each addition.

Identify the **independent** and the **dependent** variable in this investigation.

.....
.....
.....
(2 marks)

The graph of the pH curve below shows the results of her measurements.



- c. Use the graph above, state the pH of the solution at the beginning of the experiment.

pH = ... (1 mark)

- d. Use the graph above, determine the mass of calcium hydroxide required to neutralise the acid.

mass of calcium hydroxide = ... (1 mark)

(Total for Question 4 is 7 marks)

5. Potassium hydroxide reacts with dilute sulfuric acid to form potassium sulfate solution and water.
- a. Complete the balanced equation for the reaction by adding a number in front of KOH(aq).

The word equation for this reaction is:

potassium hydroxide + sulfuric acid → potassium sulfate + water

Write the balanced chemical equation for this reaction

.....
(3 marks)

- b. State **one** observation you would make during this reaction, other than a change in pH.

.....
(1 mark)

A student investigated how the pH of the mixture changed as potassium hydroxide was added to dilute sulfuric acid. The student used this method.

- **Step 1:** measure out 50 cm³ of dilute sulfuric acid into a beaker using a measuring cylinder.
- **Step 2:** use a glass rod to place a drop of the acid onto a piece of universal indicator paper and record the pH.
- **Step 3:** add one spatula measure of solid potassium hydroxide to the acid in the beaker and stir.
- **Step 4:** use the glass rod to place a drop of the mixture onto a new piece of universal indicator paper and record the pH again.
- **Step 5:** repeat steps 3 and 4 until there is no further change in the pH.

- c. Name a piece of equipment that could be used to measure the pH of a substance more accurately than universal indicator paper.

.....
(2 marks)

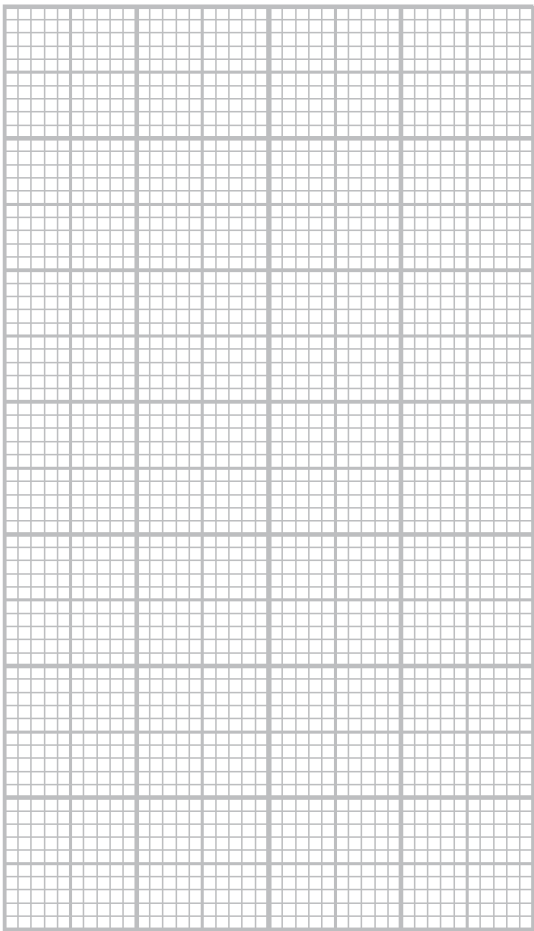
- d. Explain why, in step 3, the mixture was stirred **after** adding the potassium hydroxide.

.....
(2 marks)

The table below shows the student's results.

Number of spatula measures of potassium hydroxide	pH of mixture
0.0	1
1.0	1
2.0	2
3.0	4
4.0	12
5.0	13
6.0	13
7.0	13

- e. Plot a graph of the pH of the mixture against the number of spatula measures of potassium hydroxide.
- Include a suitable scale to the x and y axes of the graph.
 - Plot a graph of the pH of the mixture against the number of spatulas potassium hydroxide.



(3 marks)

- f. Use the graph to find the pH of the mixture when 3.5 spatula measures of potassium hydroxide are added.

pH of the mixture = ...
(1 mark)

(Total for Question 5 is 12 marks)