

Acids, Alkalis and Salts

Q1. (2018)

- 2 (a) Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.
- (i) Describe the test to show the gas is hydrogen.

(2)

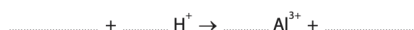
Q2. (2018) – 9c

- (c) Acid solutions contain hydrogen ions.

Aluminium reacts with dilute hydrochloric acid to form a solution containing aluminium ions, Al^{3+} .

Complete the balanced ionic equation for this reaction.

(2)



Q3. (2019)

- 3 (a) Water, acidified with sulfuric acid, is decomposed by electrolysis. The water is decomposed to produce hydrogen and oxygen.
- (i) A sample of hydrogen is mixed with air and ignited.

State what would happen.

(1)

Q4. (2019) – 9b (iii)

- (b) An experiment is planned to record the change in pH as a powdered base is added to 50 cm³ dilute hydrochloric acid.

The method suggested is

- step 1 add dilute hydrochloric acid up to the 50 cm³ mark on a beaker
- step 2 add one spatula of the base and stir
- step 3 measure the pH of the mixture
- step 4 repeat steps 2 and 3 until the pH stops changing.

- (iii) Explain, in terms of the particles present, why the pH increases during the experiment.

(2)

Q5. (2019)

A)

- 10 (a) Nitric acid can be titrated with a solution of ammonia.
- (i) State the type of reaction occurring when nitric acid reacts with ammonia.

(1)

B)

- (ii) What salt is formed in this reaction?

(1)

- ☐ A ammonia nitric
- ☐ B ammonia nitrate
- ☐ C ammonium nitric
- ☐ D ammonium nitrate

Q6. (2020)

- 2 Figure 3 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

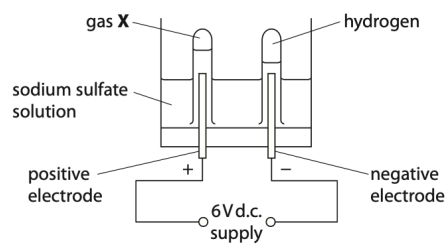


Figure 3

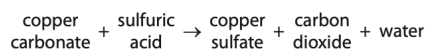
- (a) Hydrogen is produced at the negative electrode during electrolysis.

(i) Describe the test to show the gas is hydrogen.

(2)

Q7. (2020) – 3a (iii), 3b

- 3 The word equation for the reaction between copper carbonate and dilute sulfuric acid is



A)

- (iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

- ☐ A bubble the gas through limewater, limewater turns cloudy
- ☐ B put damp blue litmus paper in the gas, litmus paper turns red
- ☐ C put a lighted splint into the gas, the splint is extinguished
- ☐ D measure the pH of the gas, pH = 4

B)

- (b) Figure 4 shows a conical flask containing dilute sulfuric acid. Copper carbonate is added to the acid in the flask. The copper carbonate is added one spatula measure at a time until the reaction has finished.

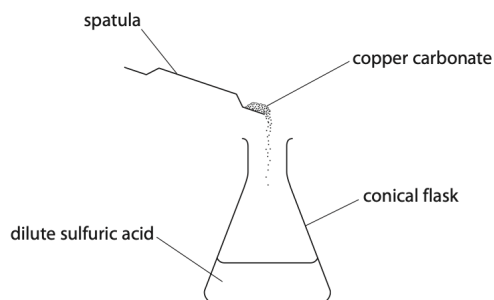


Figure 4

State **two** observations that would show the reaction has finished.

(2)

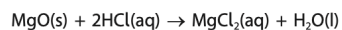
Q8. (2020)

- 9 (a) Dilute hydrochloric acid is a strong acid.
(i) Explain why dilute hydrochloric acid is described as a strong acid.

(2)

Q9. (2020) – 9b

- (b) Magnesium oxide reacts with dilute hydrochloric acid to produce magnesium chloride solution and water.



Write the ionic equation for this reaction.

(3)

Q10. (2020) – 9c (ii)

- (c) In an experiment magnesium hydroxide powder is added in 0.1 g portions to 25 cm³ of dilute hydrochloric acid until the magnesium hydroxide is just in excess.

Universal indicator paper can be used to test the pH of the solution after each addition of magnesium hydroxide.

- (ii) State and explain how the pH changes as the magnesium hydroxide is added to the dilute hydrochloric acid.

(4)

Q11. (2021) – 2c (ii, iii)

2 The scientist John Dalton lived over 200 years ago.

(c) Another gas that Dalton investigated was chlorine.

Chlorine gas reacts with water.

The two products are a solution of hydrogen chloride and the substance HClO.

A)

(ii) Hydrogen chloride solution is acidic.

The formulae of four ions are shown in Figure 3.

H^+	H^-	Cl^+	Cl^-
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Figure 3

Give the formula of the ion in Figure 3 that causes the hydrogen chloride solution to be acidic.

(1)

formula

B)

(iii) An acid reacts with an alkali.

Give the name of this type of reaction.

(1)

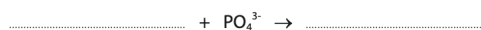
Q12. (2021) – 3d

(d) Waste water may contain phosphate ions, PO_4^{3-} .

Aluminium ions react with phosphate ions to form aluminium phosphate.

Complete the ionic equation for the formation of aluminium phosphate in this reaction.

(2)



Q13. (2021)

6 (a) Copper carbonate reacts with dilute nitric acid.

(i) During the reaction the copper carbonate powder completely disappears.

State what can be deduced about the amount of acid used.

(1)

Q14. (2022) – 9a (iii)

- 9 (a) A student carried out an investigation to determine the order of reactivity of four metals, **W**, **X**, **Y** and **Z**.
A piece of metal **W** was added to a test tube containing excess dilute hydrochloric acid.
This was repeated with the other three metals, **X**, **Y** and **Z**.
In each case, the size of each piece of metal was the same.
The student recorded observations on each reaction for three minutes.

The observations obtained are shown in Figure 8.

metal	observations with dilute hydrochloric acid
W	Bubbles formed quickly with some metal remaining after three minutes.
X	A few bubbles were seen to form. The metal looked unchanged after three minutes.
Y	Bubbles formed quickly. After three minutes all the metal had reacted.
Z	Bubbles formed very quickly with no metal remaining after three minutes.

Figure 8

- (iii) The reactions between metals and dilute ethanoic acid are slower than reactions between metals and dilute hydrochloric acid.
This is because ethanoic acid is a weak acid.

Explain the meaning of the term **weak acid**.

(2)

Q15. (2023)

- 2 In an experiment, powdered calcium hydroxide was added to dilute hydrochloric acid and the pH was measured.

The method used was

step 1 measure 200 cm³ dilute hydrochloric acid into a beaker

step 2 add 0.1 g of powdered calcium hydroxide to the beaker

step 3 find the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

- (a) State what should be done after **step 2** to make sure that any reaction is complete.

(1)

Q16. (2023) – 3b (ii, iii)

- 3 Figure 5 shows part of the reactivity series of metals.

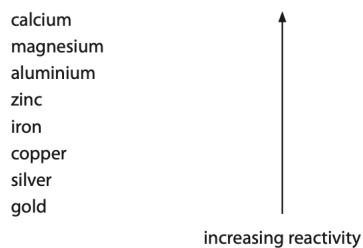


Figure 5

- (b) A student investigates the reactivity of four different metals.

The student adds an equal-sized piece of each metal to separate test tubes containing dilute hydrochloric acid.

The student's observations for zinc and copper are recorded in Figure 6.

metal	observations
magnesium	
zinc	bubbles produced at a steady rate test tube feels slightly warm
iron	
copper	no reaction

Figure 6

A)

- (ii) When metals react with acids, hydrogen gas is produced.

Describe the test to show that the gas is hydrogen.

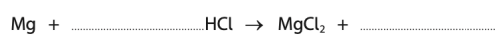
(2)

B)

- (iii) When magnesium reacts with hydrochloric acid, magnesium chloride and hydrogen are formed.

Complete the balanced equation for the reaction.

(2)



- 3 Figure 5 shows part of the reactivity series of metals.

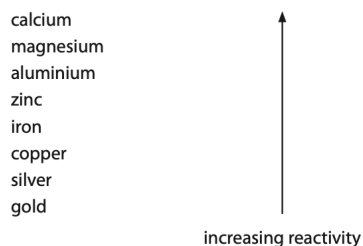


Figure 5

- (c) An excess of magnesium is added to some dilute hydrochloric acid of pH 2. The mass of hydrogen gas produced is measured.

The experiment is repeated with excess magnesium but with the same volume of dilute hydrochloric acid of pH 1.

- (ii) With the acid of pH 2, the mass of hydrogen gas produced when the reaction is complete is 0.005 g.

Predict the mass of hydrogen gas produced in the reaction with acid of pH 1.

(1)

Q18. (2023)

- 7 Titration is used to carry out some neutralisation reactions.

- (a) Ammonium nitrate can be made by neutralisation.

- (i) State the name of the two reactants that are neutralised to make the salt ammonium nitrate.

(2)

..... and

Q19. (2023)

- 8 Crystals of copper sulfate are prepared by reacting copper oxide, a base, with dilute sulfuric acid.

A)

- (a) Name the other product of this reaction.

(1)

B)

- (b) During the experiment, a spatula measure of copper oxide, a black powder, is added to warm, dilute sulfuric acid in a beaker.

When the mixture is stirred, the black powder disappears and the mixture turns pale blue.

The student then adds more copper oxide until the maximum amount of copper sulfate is formed without wasting copper oxide.

Explain how the student knows when to stop adding copper oxide.

(3)

Q20. (2024) – 2a (ii)

- 2 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride solution and water.

- (ii) State what you would see during the reaction.

(1)

Q21. (2024) – 2b (ii)

- 2 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride solution and water.
- (b) A student investigated how the pH of the mixture changed as barium hydroxide was added to dilute hydrochloric acid.
- The student used this method.
- step 1** measure out 50 cm³ of dilute hydrochloric 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 barium 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.
- (ii) Explain why, in step 3, the mixture was stirred after adding the barium hydroxide.

(2)

Q22. (2024) – 6b (ii)

- 6 Titration can be used to find the volume of dilute hydrochloric acid needed to neutralise 25.0 cm³ of barium hydroxide solution.
- (b) In the titration, a few drops of phenolphthalein indicator are added to the barium hydroxide solution.
- (ii) Write the ionic equation for the neutralisation reaction that occurs when hydrochloric acid is added to barium hydroxide solution.

(2)

Q23. (2024) – 9a (ii)

- 9 (a) An investigation was carried out on the reactivity of four metals, **D**, **E**, **F** and **G**.
- Equal sized pieces of these metals were placed in excess dilute hydrochloric acid and left for three minutes.

Figure 9 shows the observations of the reactions for metals **D**, **E** and **F**.

metal	observations with dilute hydrochloric acid
D	Bubbles formed quickly. After three minutes all the metal had reacted.
E	Bubbles formed very quickly. No metal remaining after three minutes.
F	A few bubbles were seen to form. The metal looked unchanged after three minutes.
G	

Figure 9

The order of reactivity for these metals is shown in Figure 10.

E	D	G	F
most reactive			least reactive

Figure 10

- (ii) The dilute hydrochloric acid used in this reaction is a strong acid.
- Explain the meaning of the terms **dilute** and **strong acid**.

(4)