08 Acids and Bases

Set B **Exam practice**

Name	Time 1 hour	Total 33 marks	Score ____ / 33

Use a copy of the Periodic Table where you need one.

Marks by notes section For the marker: total each row. A score below the target means that section of the notes needs revising.

Notes section	Questions	Marks	Target	Score
1 Acids	1, 2, 5, 6(a)(i), 6(a)(ii), 6(b), 6(c)(i), 6(d), 7(b), 7(c), 8(a), 8(b)(ii), 8(b)(iii)	23	14	
2 Bases and Alkalis	4	1	1	
3 The pH Scale	6(c)(ii), 8(b)(i)	4	3	
4 Oxides	3, 6(e)	2	2	
07 · 2 The Mole *(Topic 06-07)*	7(a), 7(d), 7(e)	3	2	

A Multiple choice

5 MARKS

1 Some statements about acids are given below.
I pH is a measure of the H^+ concentration in a solution.
II The strength of an acid depends on its concentration.
III Universal Indicator turns orange when placed in a solution of any acid.
IV When acids react with metals, hydrogen ions gain electrons.
Which statements about acids are correct?

A I and II only **B** I and IV only **C** I, II and III **D** I, II and IV

/1

Answer ☐ [1]

Source: 2024 SMSS Sec 3 End-of-Year P1 Q11

2 Which statements about strong and weak acids are always correct?
1 Strong acids ionise to a greater extent in water than weak acids.
2 Strong acids are more concentrated than weak acids.
3 Strong acids have a lower pH than weak acids.

A 1 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

/1

Answer ☐ [1]

Source: 2024 CHS Sec 3 End-of-Year Section A Q21

3 The reactions of four different oxides W, X, Y and Z with hydrochloric acid and sodium hydroxide solution are shown (✓ means there is a reaction and ✗ means there is no reaction). Which row shows

the correct types of oxide?

oxide	hydrochloric acid	sodium hydroxide
W	✓	✗
X	✓	✓
Y	✗	✗
Z	✗	✓

	W	X	Y	Z
A	acidic	amphoteric	neutral	basic
B	amphoteric	acidic	basic	neutral
C	basic	amphoteric	neutral	acidic
D	neutral	basic	amphoteric	acidic

/1

Answer ☐ [1]

Source: SJI 2020 Year 3 End-of-Year P1 Q25

4 A farmer adds ammonium nitrate to the soil to increase its nitrogen content. He then adds calcium hydroxide to neutralise the excess acid in the soil. Why is this not a good idea?

A Calcium hydroxide will cause the soil to become excessively alkaline.

B Calcium hydroxide will react with ammonium nitrate to release ammonia gas.

C Calcium hydroxide will react with ammonium nitrate to form calcium nitrate.

D Calcium hydroxide will make ammonium nitrate insoluble in water.

/1

Answer ☐ [1]

Source: SJI 2020 Year 3 End-of-Year P1 Q22

5 Rat poison needs to be insoluble in rainwater, but soluble in the low pH of stomach contents. Which is a suitable barium compound to use as rat poison?

A barium carbonate **B** barium chloride **C** barium nitrate **D** barium sulfate

/1

Answer ☐ [1]

Source: 2023 HYSS Sec 3 End-of-Year P1 Q16

B Structured questions

28 MARKS

6 **Acids in our daily lives.** The stomach secretes gastric juice, which contains hydrochloric acid. Barium compounds that react with gastric juice produce aqueous barium ions, which are highly poisonous. pK_a is a measure of the extent to which an acid ionises. The larger the pK_a value, the less the molecules ionise in solution, and so the weaker the acid. Table 8.1 shows the pK_a values of some acids, and the volume of carbon dioxide produced when 1 g of calcium carbonate reacts with each acid for 1 minute.

acid	pK_a	volume of CO_2 produced / cm^3
ethanoic acid	4.7	2.32
citric acid	3.1	4.02
lactic acid	3.9	3.62

carbonic acid	6.3	0.95

(a) A barium meal containing barium sulfate is often given to patients before an X-ray.

(i) Use ideas about solubility to explain why a barium meal is not poisonous.

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[1]

(ii) Explain why barium carbonate must not be used in place of barium sulfate in a barium meal.

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[2]

(b) Describe a test and the result to confirm the identity of carbon dioxide gas.

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[2]

(c)

(i) Explain how the ionisation in a weak acid differs from the ionisation of a strong acid, such as dilute hydrochloric acid.

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[2]

(ii) Using (c)(i) and the passage, state whether the pH and the pK_a of a solution of a strong acid and of a weak acid are high or low.

	pH	pK_a
strong acid	high / low	high / low
weak acid	high / low	high / low

[2]

(d) Using the passage and Table 8.1, suggest which acid is the weakest and explain your reasoning.

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[3]

(e) Suggest why carbon monoxide has no effect on litmus paper.

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[1]

/13

Source: 2023 XMS Sec 3 WA3 Q8, adapted

7 Oxalic acid, $H_2C_2O_4$, and sulfuric acid, H_2SO_4, each have two hydrogen atoms per molecule that can form H^+ ions.

(a) A 0.45 g sample of oxalic acid is dissolved in water and made up to 25.0 cm^3. Determine the amount of oxalic acid, in moles, in this solution.

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[1]

(b) Solutions of oxalic acid and sulfuric acid of the same concentration have pH values of 3.2 and 0.90. Why are the pH values different?

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[2]

(c) A student titrated 25.0 cm^3 of three acids, each 0.40 mol/dm^3, against aqueous sodium hydroxide. Hydrochloric acid and ethanoic acid each needed 16.70 cm^3, and sulfuric acid needed 33.40 cm^3. Explain the similarities and differences between these volumes.

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[3]

(d) Determine the amount of hydrogen ions, in moles, in 25.0 cm^3 of the 0.40 mol/dm^3 hydrochloric acid.

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[1]

(e) Predict the volume of the same sodium hydroxide needed to neutralise the oxalic acid solution in (a).

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[1]

/8

Source: 2026 NAS Prelim P2 Q10, adapted

8 One industrial use of ethanoic acid is to remove limescale (calcium carbonate) from steel pipes.

(a) Write the equation for the reaction that occurs when ethanoic acid reacts with calcium carbonate.

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..... **[2]**

(b) Hydrochloric acid is a strong acid and ethanoic acid is a weak acid.

(i) Describe a simple test to show which is the strong acid and which is the weak acid.

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..... **[2]**

(ii) Describe the differences between strong and weak acids.

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..... **[2]**

(iii) Explain why hydrochloric acid should not be used for removing limescale from steel pipes.

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..... **[1]**

/7

Source: 2024 BLSS Prelim P2 Q10(b) and (c)