InkChemistry

QUESTION WORKBOOK

Brønsted–Lowry acids and bases, pH and strong acids

Acids and bases · Unit C11

AQA 3.1.12.1, 3.1.12.2 · OCR A 5.1.3

16 questions · 58 marks

NAVY SCREEN EDITION

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SECTION B · Standard, 3 to 5 marks

B1 BN-Q9

Explain why diluting a solution of a strong acid tenfold raises its pH by one unit, and why hydrochloric acid of concentration 1.0×10^{-8} mol dm^{-3} does not have a pH of 8.00. [5]

B2 BN-Q1

State what is meant by a Brønsted–Lowry acid and by a Brønsted–Lowry base, and identify the two conjugate acid–base pairs in $NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$, saying which member of each pair is the acid. [4]

B3 BN-Q4

Calculate the pH of 0.0350 mol dm^{-3} nitric acid, HNO_3, a strong monoprotic acid, and the hydrogen ion concentration in a solution of pH 3.65. [4]

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B4 BN-Q5

Calculate the pH of 7.50×10^{-3} mol dm^{-3} sulfuric acid, first assuming that both protons of each molecule are fully dissociated, and then assuming that only the first dissociation takes place. [4]

B5 BN-Q16

Calculate the volume of 0.150 mol dm^{-3} sodium hydroxide needed to neutralise completely 20.0 cm^3 of 0.0500 mol dm^{-3} phosphoric(V) acid, H_3PO_4, and state what is meant by describing H_3PO_4 as tribasic. [4]

B6 BN-Q18

Give the ionic equations, with state symbols, for the reactions of dilute nitric acid with solid calcium carbonate and with magnesium ribbon. [4]

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B7 BN-Q3 Give the formula of the conjugate base of each of these acids: HSO_4^-, H_2O and NH_4^+. [3]

B8 BN-Q7 Calculate the pH of the solution made when 10.0 cm^3 of 0.200 mol dm^{-3} hydrochloric acid is diluted to 250 cm^3 with water. [3]

B9 BN-Q10 Calculate the volume of water that must be added to 50.0 cm^3 of hydrochloric acid of pH 1.00 to give a solution of pH 2.00. [3]

B10 BN-Q11 Explain why 0.100 mol dm^{-3} hydrochloric acid has a pH of 1.00 but 0.100 mol dm^{-3} ethanoic acid has a pH of 2.88. [3]

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B11 BN-Q12 Suggest the role of nitric acid in the reaction $HNO_3 + H_2SO_4 \rightarrow H_2NO_3^+ + HSO_4^-$, which takes place in a mixture of the two pure acids, and identify the two conjugate pairs. [3]

B12 BN-Q13 Suggest why the measured pH of 0.0500 mol dm^{-3} sulfuric acid is about 1.24, rather than 1.30 or 1.00. [3]

B13 BN-Q14 Compare 2.0 mol dm^{-3} ethanoic acid with 0.010 mol dm^{-3} hydrochloric acid in terms of strength and concentration, and say which has the lower pH. The ethanoic acid has a pH of 2.23. [3]

B14 BN-Q15 Evaluate a student's claim that the pH scale runs from 0 to 14 and that no solution can have a pH below 0. Use 2.00 mol dm^{-3} hydrochloric acid in your answer. [3]

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B15 BN-Q17 Explain why 25.0 cm^3 of 0.100 mol dm^{-3} hydrochloric acid reacts faster with excess magnesium than 25.0 cm^3 of 0.100 mol dm^{-3} ethanoic acid, yet both give the same total amount of hydrogen. [3]

SECTION C · Long, 6 marks or more

C1 BN-Q2 Discuss a student's claim that 'watering hydrochloric acid down turns it into a weak acid'. Use 0.100 mol dm^{-3} hydrochloric acid diluted tenfold, and 0.100 mol dm^{-3} ethanoic acid of pH 2.88, in your answer. [6]

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