InkChemistry

QUESTION WORKBOOK

Half-equations and building redox equations

Redox · Unit C07

AQA 3.1.7, 3.2.3.2 · OCR A 2.1.5, 3.1.3, 5.2.3

20 questions · 68 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 HEB-Q13

Identify the species oxidised and the species reduced in the reaction $3Cu(s) + 8H^+(aq) + 2NO_3^-(aq) \rightarrow 3Cu^{2+}(aq) + 2NO(g) + 4H_2O(l)$, giving the change in oxidation state for each. [2]

SECTION B · Standard, 3 to 5 marks

B1 HEB-Q3

Give the half-equations for the oxidation of iodide ions to iodine and for the reduction of hydrogen peroxide to water in acid, and combine them into an overall ionic equation. [4]

B2 HEB-Q7

Explain why the reaction of chlorine with cold, dilute sodium hydroxide is described as disproportionation. Include an equation. [4]

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B3 HEB-Q10 Outline the steps used to construct a half-equation for a reaction in acidic solution. [4]

B4 HEB-Q14 Compare the reaction of chlorine with water with the reaction of chlorine with cold, dilute sodium hydroxide, and explain why both are described as disproportionation. [4]

B5 HEB-Q21 Deduce the half-equation for the reduction of iodate(V) ions, IO_3^-, to iodine in acidic solution, and use it to deduce the overall equation for the reaction of iodate(V) ions with iodide ions in acid. [4]

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B6 HEB-Q22 Show that one mole of dichromate(VI) ions oxidises six moles of iron(II) ions in acidic solution, by constructing the two half-equations and combining them. [4]

B7 HEB-Q2 Complete the half-equation for the reduction of dichromate(VI) ions to chromium(III) ions in acid, $Cr_2O_7^{2-}(aq) \rightarrow 2Cr^{3+}(aq)$, and check the number of electrons against the change in oxidation state. [3]

B8 HEB-Q4 Calculate the mass of iodine formed when 25.0 cm^3 of 0.0500 mol dm^{-3} acidified potassium dichromate(VI) reacts with excess potassium iodide: $Cr_2O_7^{2-} + 14H^+ + 6I^- \rightarrow 2Cr^{3+} + 3I_2 + 7H_2O$. Mr of I_2 is 253.8. [3]

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B9 HEB-Q5 Calculate the final oxidation state of a metal X when 2.40×10^{-3} mol of X^{2+} ions are oxidised by exactly 9.60×10^{-4} mol of MnO_4^- ions in acid, the MnO_4^- being reduced to Mn^{2+}. [3]

B10 HEB-Q6 Explain why two half-equations must contain the same number of electrons before they are added to give an overall redox equation. [3]

B11 HEB-Q8 Explain why chlorine is added to drinking water even though chlorine is toxic. [3]

B12 HEB-Q11 Suggest a half-equation for the reduction of VO_2^+ ions to VO^{2+} ions in acidic solution. [3]

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B13 HEB-Q12 Suggest the two half-equations and the overall equation for the reaction in which concentrated sulfuric acid oxidises bromide ions to bromine and is reduced to sulfur dioxide. [3]

B14 HEB-Q15 Evaluate the half-equation $MnO_4^-(aq) + 8H^+(aq) + 3e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$, written by a student for the reduction of manganate(VII) in acid. [3]

B15 HEB-Q16 Describe what is seen when zinc powder is stirred into copper(II) sulfate solution, and give the two half-equations and the ionic equation for the reaction. [3]

B16 HEB-Q18 Explain, using oxidation states, why the reaction of chlorine with hot, concentrated sodium hydroxide gives five moles of sodium chloride for every mole of sodium chlorate(V): $3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$. [3]

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B17 HEB-Q19 Suggest a half-equation for the oxidation of sulfite ions, SO_3^{2-}, to sulfate ions, SO_4^{2-}, in alkaline solution. [3]

B18 HEB-Q20 Complete and balance, using changes in oxidation number, the equation for the reduction of concentrated sulfuric acid to hydrogen sulfide by iodide ions: $H_2SO_4 + H^+ + I^- \rightarrow H_2S + I_2 + H_2O$. [3]

SECTION C · Long, 6 marks or more

C1 HEB-Q17 Explain, using half-equations and oxidation states, how the overall equation is built for the oxidation of ethanol, CH_3CH_2OH, to ethanal, CH_3CHO, by acidified potassium dichromate(VI), and state what is seen. [6]

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