InkChemistry

QUESTION WORKBOOK

Oxidation states and the rules for assigning them

Redox · Unit C07

AQA 3.1.7 · OCR A 2.1.5

19 questions · 65 marks

NAVY SCREEN EDITION

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SECTION B · Standard, 3 to 5 marks

B1 OSR-Q2

Give the oxidation state of sulfur in H_2SO_4, of nitrogen in NO_2, of chlorine in ClO_3^- and of manganese in MnO_4^{2-}. [4]

B2 OSR-Q6

Explain, using the definitions of oxidation and reduction in terms of electrons, why the reaction $Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$ is a redox reaction even though it involves no oxygen. [4]

B3 OSR-Q9

Name the compounds Cu_2O and $NaClO_3$, using Roman numerals for oxidation states, and give the formulae of iron(III) sulfate and of potassium manganate(VII). [4]

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B4 OSR-Q16 Deduce the oxidation state of phosphorus in $H_4P_2O_7$, of nitrogen in hydrazine, N_2H_4, of chlorine in Cl_2O_7 and of hydrogen in calcium hydride, CaH_2. [4]

B5 OSR-Q17 Explain, using oxidation states, why the reaction of concentrated sulfuric acid with sodium bromide to give bromine and sulfur dioxide is a redox reaction, and identify the oxidising agent. [4]

B6 OSR-Q3 Deduce the mean oxidation state of iron in the mixed oxide Fe_3O_4, and explain how the oxidation states of the iron ions present account for it. [3]

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B7 OSR-Q4 Calculate the final oxidation state of vanadium when 25.0 cm^3 of a 0.100 mol dm^{-3} solution of vanadium in the +5 oxidation state is reduced by zinc in acid and accepts 5.00×10^{-3} mol of electrons. [3]

B8 OSR-Q5 Explain why oxygen has an oxidation state of +2 in OF_2 but -2 in H_2O. [3]

B9 OSR-Q7 Explain why it is wrong to give the oxidation state of nitrogen in ammonium nitrate, NH_4NO_3, as +1. [3]

B10 OSR-Q8 Identify the oxidising agent and the reducing agent in the thermite reaction, $2Al(s) + Fe_2O_3(s) \rightarrow Al_2O_3(s) + 2Fe(l)$, giving the change in oxidation state of each element. [3]

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B11 OSR-Q11 Suggest the oxidation state of hydrogen in lithium aluminium hydride, $LiAlH_4$, and suggest why this compound is a strong reducing agent. [3]

B12 OSR-Q12 Suggest, using oxidation states, why thiosulfate ions, $S_2O_3^{2-}$, act as a reducing agent when they react with iodine to form tetrathionate ions, $S_4O_6^{2-}$. [3]

B13 OSR-Q13 Compare the definition of oxidation as gain of oxygen with the definitions in terms of electrons and of oxidation state. [3]

B14 OSR-Q14 Evaluate a student's claim that hydrogen is reduced in the reaction $H_2O_2(aq) + 2H^+(aq) + 2I^-(aq) \rightarrow I_2(aq) + 2H_2O(l)$. [3]

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B15 OSR-Q15 Describe the changes in oxidation state when hydrogen sulfide burns in oxygen, $2H_2S(g) + 3O_2(g) \rightarrow 2SO_2(g) + 2H_2O(l)$, and identify the reducing agent. [3]

B16 OSR-Q18 Explain why the reaction of magnesium with dilute sulfuric acid is a redox reaction, but the reaction of magnesium oxide with dilute sulfuric acid is not. [3]

B17 OSR-Q19 Deduce the oxidation state of the metal in each of the complex ions $[Cr(NH_3)_4Cl_2]^+$, $[Co(NH_3)_6]^{3+}$ and $[Ni(CN)_4]^{2-}$. [3]

B18 OSR-Q20 Suggest an equation for the reaction of barium with chlorine, and suggest how its vigour compares with that of magnesium with chlorine, giving a reason. [3]

SECTION C · Long, 6 marks or more

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C1 OSR-Q21 Explain, using oxidation states, which species are oxidised and reduced in the reaction $2KMnO_4(s) + 16HCl(aq) \rightarrow 2KCl(aq) + 2MnCl_2(aq) + 5Cl_2(g) + 8H_2O(l)$, and why hydrochloric acid acts both as a reducing agent and as an acid in it. [6]

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