2.12 Chemistry: Electrode Potentials and Transition Metals: 10-minute Pack

AQA 7405 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 This question is about general properties of transition elements and a calculation on a hydrated transition metal salt.

(a) Explain, referring to the energies of the 3d and 4s orbitals, why transition metals commonly show variable oxidation states. **(2)**

(b) State two characteristic properties, other than variable oxidation states, that are shared by transition metals and/or their compounds. **(2)**

(c) A sample of hydrated cobalt(II) chloride, $CoCl_2.xH2O$, has a molar mass of 237.9 g mol-1. Given that the molar mass of anhydrous $CoCl_2$ is 129.9 g mol-1, calculate x, the number of moles of water of crystallisation per mole of $CoCl_2$. **(4)**

(Total for Question 1 is 8 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 2.12 Chemistry: Electrode Potentials and Transition Metals: 10-minute Pack

Question 1

(a) the 3d and 4s sub-shells are very close together in energy (oe) **M1**

(a) so successive ionisation energies (for removing electrons beyond the first two 4s electrons, from the 3d sub-shell) increase relatively gradually, without one very large jump, allowing a variable number of electrons to be lost to form ions of different, comparably-stable oxidation states (oe) **A1**

(a) Answer: The 3d and 4s orbitals are close in energy, so successive ionisation energies increase gradually rather than showing one large jump, allowing several oxidation states to be reasonably stable.

(b) forming coloured compounds/ions (in solution or as solids) **B1**

(b) acting as catalysts (as elements or as compounds/ions); allow forming complex ions with ligands as an alternative second property **B1**

(b) Answer: For example: forming coloured compounds/ions, and acting as catalysts (or forming complex ions with ligands).

(c) mass attributable to water = 237.9 - 129.9 = 108.0 **M1**

(c) x = 108.0 / 18.0 **M1**

(c) x = 6.00 cao **A1**

(c) so the formula is $CoCl_2.6H_2O$ **B1**

(c) Answer: x = 6; the formula is $CoCl_2.6H_2O$.

© Revision Library | revisionlibrary.co.uk