

Redox test

Chemistry IB12

Name:

Date:

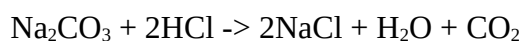
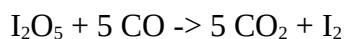
1. In the compounds NF_3 , SeO_2 and Na_2SO_3 , the oxidation numbers of N, Se and S are: [3]

- A. +3, +2 and +4
- B. -3, +2 and +4
- C. -3, +2 and +6
- D. +3, +4 and +4

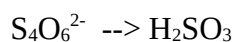
2. In the compounds NO_3^- , $\text{Cr}_2\text{O}_7^{2-}$, H_2O_2 and AlH_3 , the oxidation numbers of N, Cr, O and Al are: [4]

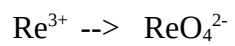
- A. +3, +7, -2 and +3
- B. +5, +8, -2 and -3
- C. +5, +7, -2 and +3
- D. +3, +8, -2 and +3
- E. +5, +6, -1 and +3
- F. +5, +6, -2 and +3

3. In these reactions, state which element is reduced and which element is oxidized. [2 per reaction]



4. Complete and balance these half-reactions in acid **and** basic medium [2 per reaction]





5. Using the activity series or the table of standard redox potentials, determine which of these pairs will react and explain how you can tell. [2 each]

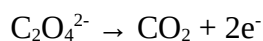
a. AlCl_3 and Fe^0

b. FeSO_4 and NiSO_4

c. Cu^+ and Cu^+ [HL]

6. Certain canned vegetables have a substantial amount of oxalic acid $\text{H}_2\text{C}_2\text{O}_4$, which ought to be taken in to account by people who suffer from kidney stones.

Oxalate ion $\text{C}_2\text{O}_4^{2-}$ is a mild reducing agent, undergoing the (unbalanced) half-reaction



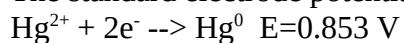
In order to determine the concentration of oxalate in the juice used as filling in the canned vegetables, 60 g of said juice were diluted to a volume of 500 ml.

Of this solution, 30g were picked and titrated using a 0.0011 M permanganate solution, requiring 13ml until the change of colour.

- a) Calculate the concentration of oxalate in the solution titrated. [2]
- b) Calculate the concentration (in ppm or %) of oxalic acid in the juice [2]

7. In the science-fiction novel *Twenty Thousand Leagues Under the Sea*, by Jules Verne, the ship *Nautilus* is powered electrically with batteries that use mercury and sodium.

The standard electrode potential for mercury can be taken as



- a) Draw the cells assuming an ionic bridge between them. [3]
- b) Write the cell notation.[2]
- c) Calculate the electric voltage given by it [HL] [2]

8. Calculate ΔG of the reaction between silver nitrate and iron. [HL][2]

9. A chemistry student attempts to obtain calcium and chlorine by electrolysing a solution of CaCl_2 . Assume she's using platinum electrodes and a sufficiently powerful electricity source. Answer the following question in detail, writing the reactions that take place. [HL]

- a) Will she obtain calcium? Why? [2]
- b) Will she obtain chlorine? Why? [2]
- c) What would happen if she used CuCl_2 ? [3]