

Year 12 ATAR Chemistry

Topic Test

Redox

2017

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| Section | Possible mark | Actual Mark | Percentage |
| A: Multiple Choice | 15 |  |  |
| B: Short Answer | 40 |  |  |
| TOTAL | 55 |  |  |

Time permitted for completion of the test: 55 minutes.

Part A Multiple Choice

1. In which of the following equations is the underlined species being oxidised?
   1. Ca2+(aq) CO2­‾ 3 (aq)  **** CaCO3(s)
   2. Zn2+(aq) + Fe(s)  **** Zn(s) + Fe2+(aq)
   3. 2H++(aq) + Mg(s) **** Mg2+(aq) + H2(g)
   4. 2I‾(aq) + Br2(g) **** I2(aq) + 2Br‾ (aq)
2. Which of the following statements about oxidising and reducing agents is false?

(a) Bromine water can oxidise chloride ions to chlorine.

(b) Hydrogen peroxide solution is capable of spontaneous disproportionation.

(c) Group I metals are good reducing agents.

(d) Copper metal will react with a dilute silver nitrate solution.

1. An electrochemical cell based on the following reaction has an E0 = 1.03 V

Cl2 + 2V3+ + 2H2O -🡪 2VO2+ + 4H+ + 2Cl-

What is the standard reduction potential for VO2+ to V3+?

1. -3.05 V
2. -0.33V
3. +0.33 V
4. +3.05V
5. In which of the following reactions is the manganese containing species acting as a reducing agent?
6. MnO + Mg Mn + MgO
7. MnCl2 + 2H2O + Cl2 MnO2 + 4Cl- + 4H+
8. MnO2 + 2Ag + 4H+ Mn2+ + 2Ag+ + 2H2O
9. MnO4- + 5Fe2+ + 8H+ Mn2+ + 5Fe3+ + 4H2O
10. An electrochemical cell is formed by coupling Ag+/Ag and Sn2+/Sn in standard half cells

Sn2+(aq) + 2e- -🡪 Sn(s) E0 = - 0.14V

Ag+(aq) + e- -🡪 Ag(s) E0 = + 0.80V

The cell EMF is

1. 0.94 V
2. 0.66 V
3. 1.74 V
4. 1.46 V
5. A student made the following observations:
6. clean metal A did not react with 1.0M B2+
7. clean metal B dissolved in 1.0M C2+ and crystals of C appeared
8. Clean metal C did not react with 1.0M A2+

The order of strength as a reducing agent is

1. A > B > C
2. A > C > B
3. B > C > A
4. B > A > C
5. The oxidation number for chromium in the dichromate ion (Cr2O72-) is:
6. +6
7. -6
8. +3
9. -3
10. Which of the following statements best describes the function of a hydrogen/oxygen fuel cell?
11. It converts thermal energy from a chemical reaction into electrical energy.
12. It stores electrical energy produced from the reaction between H2 and O2.
13. It converts energy from the oxidation of H2 directly into electrical energy.
14. It promotes the reaction between H2 and O2 using an external energy source.
15. Which of the following cells would you expect to produce the highest e.m.f.? (*Assume all electrolytes to be 1 molar aqueous solutions.)*
    1. Mg/Mg2+ // Zn2+/Zn
    2. Mg/Mg2+ //Fe2+/Fe
    3. Mg/Mg2+ // Ni2+/Ni
    4. Mg/Mg2*+* // Cu2+/Cu
16. The reason that the half-reaction

2H+(aq) + 2e‾  H2(g)  has an Eo value of 0.000 V is that:

* 1. It is most often used by scientist.
  2. This is an arbitrarily set reference.
  3. The value is known accurately.
  4. Hydrogen is not a liquid at 250C.

1. The purpose of a salt bridge in an electrochemical cell is to:
   1. Separate the two half-cells physically, but provide a complete circuit for the movement of electrons:
   2. Separate the two half-cells physically, but allow the passage of ions.
   3. Permit a migration of positive ions to the reduction half-cell only.
   4. Permit a migration of positive ions to the oxidation half-cell only.
2. Which of the following is an example of an oxidation-reduction reaction?
3. 2 K2CrO4 + H2SO4 → K2Cr2O7 + K2SO4 + H2O
4. CaC2 + 2 H2O → Ca(OH)2 + C2H2
5. 2 Na + Cl2 → 2 NaCl
6. BaSO3 + 2 HCl → BaCl2 + H2O + SO2
7. A small piece of silver is placed in a solution containing both magnesium nitrate and copper (II) nitrate. Which one of the following is expected to occur?
8. Nothing.
9. The silver dissolves and only copper is precipitated.
10. The silver dissolves and only magnesium is precipitated.
11. A mixture of magnesium and copper forms on the silver.
12. Car batteries of the lead-acid type when providing electricity have the overall reaction

Pb(s) + PbO2(s) + 4 H+(aq) + 2 SO42▔(aq) → 2 PbSO4(s) + 2 H2O(l)

In the ***recharging process*** it follows that

1. The pH of the solution in the battery increases.
2. All Pb2+ ions in the battery are oxidised to Pb4+ ions.
3. The lead plates in the battery dissolve as Pb2+ ions are produced.
4. Pb2+ ions are either oxidised or reduced depending on electrode they collide with.
5. Which of the following statements about oxidation and reduction is FALSE?
6. Oxidation and reduction occur simultaneously.
7. The oxidising agent is reduced.
8. More electrons are produced by the substance being oxidised than accepted by the substance being reduced.
9. The reducing agent loses electrons in an oxidation-reduction reaction.

Part B Short answer

1. Give fully balanced ionic equations for any reactions that occur in the following. Describe two observations for each reaction which proceeds.
2. A piece of zinc is dropped into copper (II) sulphate solution

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Chlorine water is mixed with potassium bromide solution

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Potassium dichromate solution is poured into hydrogen peroxide solution.

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Observation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[6]

1. Lenses in sunglasses that darken in response to sunlight are called photo chromatic lenses. The glass contains silver chloride crystals. When the silver chloride crystals are exposed to sunlight, atoms of silver and chlorine are produced.
2. Write the balanced net ionic equation for the conversion of silver ions and chloride ions to their respective atoms. (No states of matter are required.)

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1. Give the formula of the oxidant in the above equation. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. To prevent the reaction from reversing immediately, a small quantity of a Cu (I) compound is present in these silver chloride crystals to react with the chlorine atoms. Write balanced half equations for the oxidation and reduction processes.

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[4]

1. The proportion of sulphur dioxide gas present in polluted air can be determined by bubbling the polluted air through an acidified potassium permanganate solution. The sulphur dioxide present in the air is oxidised to sulphate ions.
2. Write the half equation to show the conversion of sulphur dioxide gas to sulphate ions.

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1. Write the balanced equation for the overall reaction between sulphur dioxide and the acidified potassium permanganate solution.

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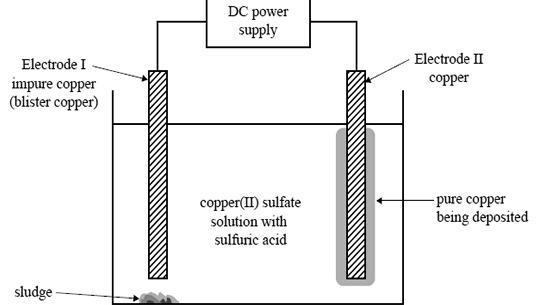
1. No indicator is required to be added to this experiment to signal the end-point of the reaction. Give a reason for this observation.

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[4]

1. An electrolytic cell is set up to obtain pure copper from an impure piece of copper called 'blister’ copper. The electrolyte solution contains both copper (II) sulphate and sulphuric acid. The cell voltage is adjusted so that only copper is deposited on Electrode II. Sludge, which contains some of the solid metal impurities present in the blister copper,  
   forms beneath Electrode I. The other impurities remain in solution as ions.  
   The diagram below represents the cell.

1. List two metal impurities that might be present in the ‘blister’ copper.

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1. Label electrode in the diagram which represents the cathode.
2. Write the half equation for the process occurring at the cathode

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1. What is the correct term for this industrial electrolytic process?

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[5]

1. An electrochemical cell was constructed from two half cells. One half cell consisted of silver metal and silver nitrate and the other half cell consisted of nickel metal and a nickel nitrate solution.
2. Draw a fully labelled diagram of the electrochemical cell including the anode and the cathode and indicate the direction of the electron flow.
3. Write the half equation for the reaction happening at the anode.

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1. Write the half equation for the reaction happening at the cathode.

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1. Write the equation for the overall reaction occurring in the cell.

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1. The voltage of the cell was measured and found to be 0.80V. What voltage would be expected from the data provided in the standard reduction potential table? Suggest two reasons for the difference.

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[10]

1. Define disproportionation and explain the concept using half equations for one species that you have studied.

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[2]

1. To obtain magnesium metal, molten magnesium chloride is electrolysed. For this electrolysis reaction:
2. Name the substance that is obtained at the anode.

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1. Name the substance that is obtained at the cathode.

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1. Write the half equations for the:

Anode: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Cathode: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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[5]

1. Iodine stains can be removed from clothes by using a concentrated solution of sodium thiosulphate, Na2S2O3. In this reaction the thiosulphate ion is converted into the tetrathionate ion, S4O6. Both of these ions are colourless.
2. Explain how the thiosulphate ion is able to remove the iodine stain. Illustrate your answer with a balanced equation.

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1. Which species in this reaction is acting as a reducing agent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[4]