

Year 12 ATAR Chemistry

Topic Test

Redox (1)

Term 4 2017

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

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

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| --- | --- | --- | --- |
| Section | Possible mark | Actual Mark | Percentage |
| A: Multiple Choice | 11 |  |  |
| B: Short Answer | 39 |  |  |
| TOTAL | 50 |  |  |

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. In which of the following reactions is the manganese containing species acting as a reducing agent?
2. MnO + Mg Mn + MgO
3. MnCl2 + 2H2O + Cl2 MnO2 + 4Cl- + 4H+
4. MnO2 + 2Ag + 4H+ Mn2+ + 2Ag+ + 2H2O
5. MnO4- + 5Fe2+ + 8H+ Mn2+ + 5Fe3+ + 4H2O
6. A student made the following observations:
7. clean metal A did not react with 1.0M B2+
8. clean metal B dissolved in 1.0M C2+ and crystals of C appeared
9. 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. 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. Which of the following is an example of an oxidation-reduction reaction?
2. 2 K2CrO4 + H2SO4 → K2Cr2O7 + K2SO4 + H2O
3. CaC2 + 2 H2O → Ca(OH)2 + C2H2
4. 2 Na + Cl2 → 2 NaCl
5. BaSO3 + 2 HCl → BaCl2 + H2O + SO2
6. 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?
7. Nothing.
8. The silver dissolves and only copper is precipitated.
9. The silver dissolves and only magnesium is precipitated.
10. A mixture of magnesium and copper forms on the silver.
11. Which of the following statements about oxidation and reduction is FALSE?
12. Oxidation and reduction occur simultaneously.
13. The oxidising agent is reduced.
14. More electrons are produced by the substance being oxidised than accepted by the substance being reduced.
15. The reducing agent loses electrons in an oxidation-reduction reaction.
16. Copper reacts with nitric acid as shown in the redox equation below:

Cu(s) + 4H+(aq) + 2NO3- Cu2+(aq) + 2NO2(g) + 2H2O(l)

Which one of the following states the change in oxidation number of nitrogen?

* + 1. 3+ to 0
    2. 5+ to 4+
    3. 3+ to 2+
    4. 5+ to 0

1. Which one of the following reactions will be spontaneous under standard conditions?
2. Cr2O72-(aq) + 3H2O(l) + 8H+ 2Cr3+(aq) + 7H2O(l) + 3O2(g)
3. 3O2(g) + 4Au(s) + 12H+ 4Au3+(aq) + 6H2O(l)
4. 2Ag+(aq) + 2Br-  2Ag(s) + Br2(l)
5. 2Cl-(aq) + I2(s) Cl2(g) + 2I-(aq)

Part B Short answer

1. Below is a results table similar to the one you used in class. Complete the missing entries in the table and answer the following questions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Cu(s)** | **Pb(s)** | **Zn(s)** | **Mg(s)** |
| **Cu2+** | **NVR** | **Blue solution fades and black deposit forms** |  |  |
| **Pb2+** | **NVR** | **NVR** |  |  |
| **Zn2+** | **NVR** |  | **NVR** | **Grey metal dissolves and a black deposit forms** |
| **Mg2+** |  | **NVR** | **NVR** | **NVR** |

[3]

a) From the results above identify which of the metals is the strongest reducing agent.

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b) Explain your answer to a)

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[3]

1. Iron (II) sulphide can cause fires in marine oil tankers. The iron (II) sulphide is formed by the reaction of rust (Fe2O3) with hydrogen sulphide released from the crude oil. The formation of iron (II) sulphide is represented by:

Fe2O3(s) + 3H2S(g) 2FeS(s) + S(s) + 3H2O(l)

1. Define the term oxidant.

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[2]

1. Identify which species has been:
2. Oxidised \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Reduced \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What is the oxidation state of sulphur in:
5. Hydrogen sulphide \_\_\_\_\_\_\_\_\_\_
6. Sulfur \_\_\_\_\_\_\_\_\_\_
7. Sulfuric acid \_\_\_\_\_\_\_\_\_\_

[5]

1. Balance the following redox equation by determining and then combining the oxidation and reduction half equations. State symbols are not required.

SCN- + IO3- + Cl- SO42- + HCN + ICl

Ox: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Red: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NIE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[6]

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: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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

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1. Chlorine water is mixed with potassium bromide solution

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

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

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

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

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

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

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

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

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[2]

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]