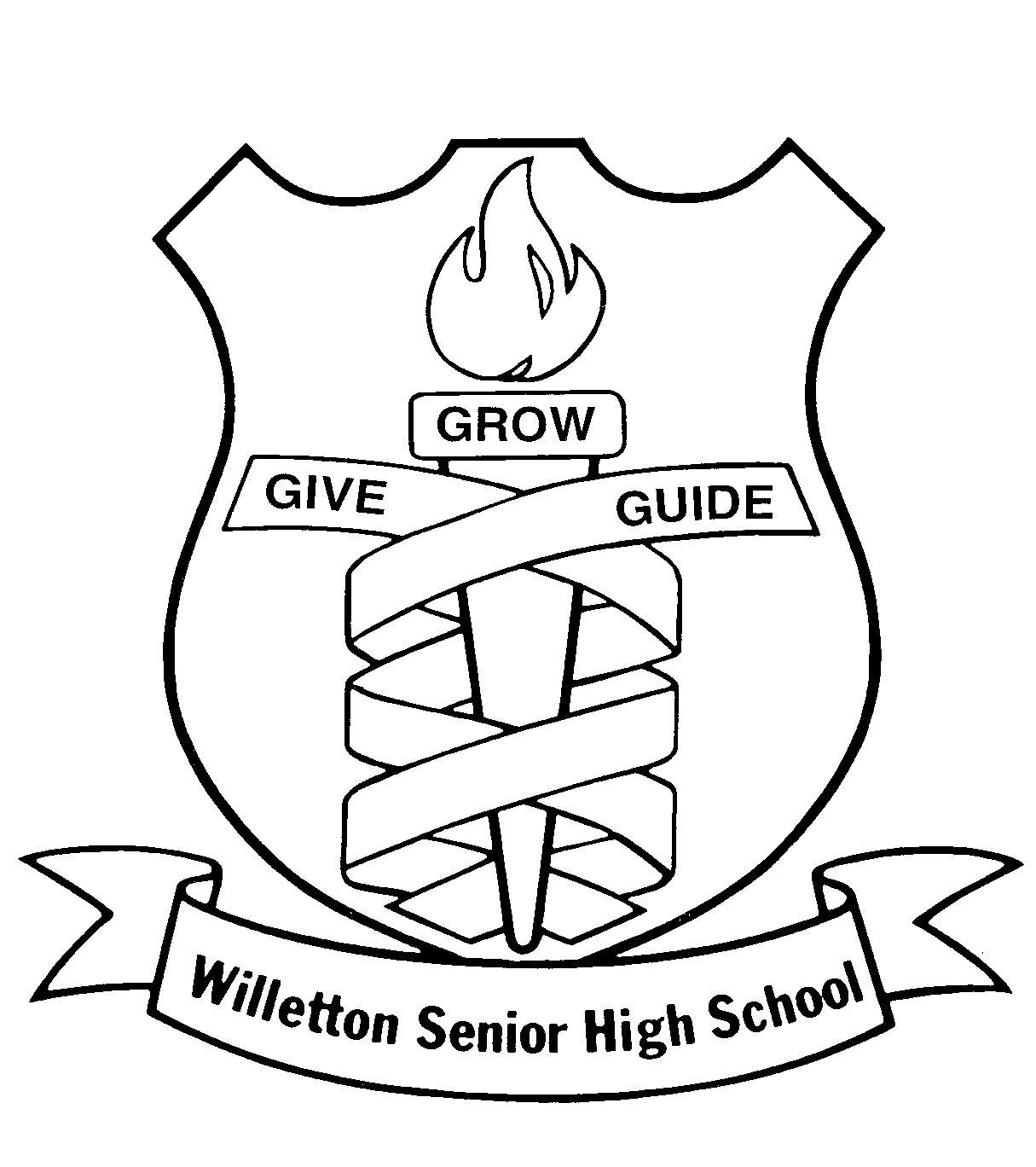
**YEAR 12 CHEMISTRY ATCHE**

**TEST 3 2021**

**Redox reactions, Electrochemical cells,**

**/30**

**Corrosion**

**Recommended time: 40 minutes**

This test consists of two (2) parts.

**Part 1:** Multiple choice style consisting of TEN (10) questions.

Each question is worth 1 mark.

Write your answers on this booklet.

Attempt ALL Questions.

**Part 2:** Short and/or Extended Answer questions

Write all answers in the spaces provided.

The marks allocated are shown next to each question.

Total: 20 marks.

Answer Booklet

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

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

### MULTIPLE CHOICE ANSWER SHEET

|  |  |
| --- | --- |
| **1** | a □ b □ c □ d □ |
| **2** | a □ b □ c □ d □ |
| **3** | a □ b □ c □ d □ |
| **4** | a □ b □ c □ d □ |
| **5** | a □ b □ c □ d □ |
| **6** | a □ b □ c □ d □ |
| **7** | a □ b □ c □ d □ |
| **8** | a □ b □ c □ d □ |
| **9** | a □ b □ c □ d □ |
| **10** | a □ b □ c □ d □ |

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| --- | --- | --- | --- |
|  | Multi Choice | Written Response | Total |
| Score | /10 | /20 | /30 |

**Written Response Questions: 20 Marks**

**1.**The **unbalanced** equation for the reaction between KMnO4 and ClO2–  ion in acidic solution is

MnO4– + ClO2–  + H+ 🡒 MnO2 + ClO4– + H2O

a. Given this information construct the relevant ionic half equations and then combine these to produce the overall ionic redox equation. (**States are not required)** (3 marks)

|  |  |
| --- | --- |
| Oxidation  Half-equation |  |
| Reduction  Half-equation |  |
| *Working Space* |  |
| Overall redox equation |  |

b. Write one observation when the above reaction occurs. (1 mark)

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1. Consider the electrochemical cell below: (8 marks)

The Leclanché cell was invented and patented in 1866. It was a primary cell, that was later developed into the dry cell. The Leclanché cell was very successful and quickly became used to power early telephones and electric bells. The diagram below shows the original Leclanché design.

ammonium chloride solution

zinc rod

porous pot

mixture of powdered carbon and manganese(IV) oxide

carbon rod

vent

glass jar

bell

electrons

The relevant half-equations are given in the table below.

|  |  |
| --- | --- |
| MnO2(s) + 2 NH4+(aq) + 2 e- → Mn2O3(s) + 2 NH3(aq) + H2O(l) | E0(red) = |
| Zn(s) → Zn2+(aq) + 2 e- | E0(ox) = |

(a) Define a primary cell. (1 mark)

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(b) In the boxes on the diagram above, label the

* anode and cathode,
* polarity of each electrode, and
* direction of electron flow. (3 marks)

(c) The Leclanché cell provides an EMF of +1.4 V. If this EMF was produced under standard conditions, complete the table above by adding in the E0 values. (2 marks)

(d) Which component on the diagram above is acting as the ‘salt bridge’? Describe the functions of this component. (2 marks)

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1. (8 marks)

The Betts process is an expensive electro refining technique used to purify lead, when very high purity lead metal is required. In this process, the electrolyte is composed of a lead(II) fluorosilicate and hexafluorosilicic acid mixture, PbSiF6­­(aq) / H2SiF6(aq). The temperature of the electrolyte is maintained at 45 °C and an electric potential of 0.5 V is applied.

The basis of this electro refining process is very similar to that used for copper metal, with some of the metal impurities entering the electrolyte solution, and some forming an anode mud.

The diagram below is a simplified representation of the Betts process.

pure lead

impure lead

power source

(a) On the diagram above, label the

* direction of electron flow through the power source, and
* direction of cation flow. (2 marks)

(b) Write balanced half-equations representing the processes occurring at the cathode and the anode. (2 marks)

|  |  |
| --- | --- |
| cathode |  |
| anode |  |

(c) Use the Standard Reduction Potential table to determine the overall EMF for this process. (1 mark)

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(d) In this industrial process, the voltage applied was 0.5 V. State one(1) possible reason as to why this voltage is applied. (1 mark)

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(e) If copper metal was one of the impurities in the lead, would this likely be found in the electrolyte or the anode mud, once the electro refining process was complete? Justify your answer. (2 marks)

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**End of Written Response Questions**