

## Chemistry 12

# Electrochemistry Practice Test

Name:

Date:

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### I. Multiple Choice

\_\_\_\_ 1. When an electrode loses mass, it also:

- A. loses electrons
- B. acts as an oxidizing agent
- C. becomes reduced
- D. decreases in oxidation number

\_\_\_\_ 2. At standard conditions,  $\text{Fe}^{+2}$  reacts spontaneously with

- A.  $\text{I}_2$
- B.  $\text{Br}^-$
- C.  $\text{Co}$
- D.  $\text{Ag}^+$

3. Explain your answer to the question above:

\_\_\_\_ 4. Which of the following half-reactions is balanced?

- A.  $\text{SO}_4^{2-} + \text{H}_2\text{O} \rightarrow \text{SO}_3^{2-} + 2\text{H}^+ + 2\text{e}^-$
- B.  $\text{SO}_4^{2-} + \text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{SO}_3^{2-} + 2\text{H}^+$
- C.  $\text{SO}_4^{2-} + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{SO}_3^{2-} + \text{H}_2\text{O}$
- D.  $\text{SO}_4^{2-} + 2\text{H}^+ \rightarrow \text{SO}_3^{2-} + \text{H}_2\text{O} + 2\text{e}^-$

\_\_\_\_ 5. During a redox reaction, the oxidizing agent:

- A. reduces other species
- B. increases in oxidation number
- C. gains electrons
- D. becomes oxidized

\_\_\_\_ 6. For a given redox rxn, the oxidation # of tin changed from +2 to +4. As a result, tin:

- A. lost 2 electrons and was reduced
- B. gained 2 electrons and was reduced
- C. lost 2 electrons and was oxidized
- D. gained 2 electrons and was oxidized

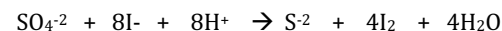
\_\_\_\_ 7. In which of the following compounds does carbon have an oxidation number of -2?

- A.  $\text{CO}$
- B.  $\text{CH}_2\text{O}$
- C.  $\text{CO}_2$
- D.  $\text{CH}_3\text{OH}$

\_\_\_\_ 8. Which of the following equations represents a redox reaction?

- A.  $\text{ZnCl}_2 \rightarrow \text{Zn}^{2+} + 2\text{Cl}^-$
- B.  $\text{Zn} + \text{Br}_2 \rightarrow \text{ZnBr}_2$
- C.  $\text{H}_2\text{CO}_3 \rightarrow \text{H}_2\text{O} + \text{CO}_2$
- D.  $2\text{NaI} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbI}_2 + \text{NaNO}_3$

\_\_\_\_ 9. Consider the following reaction:



The reducing agent is

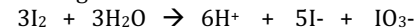
- A.  $\text{I}^-$
- B. S in  $\text{SO}_4^{2-}$
- C.  $\text{H}^+$
- D. O in  $\text{SO}_4^{2-}$

\_\_\_\_ 10. When  $\text{MnO}_4^{2-}$  undergoes oxidation, it may form:

- A.  $\text{MnO}$
- B.  $\text{MnO}_3$
- C.  $\text{MnO}_4^-$
- D.  $\text{Mn}_2\text{O}_3$

11. Explain your answer to the question above:

\_\_\_\_ 12. Consider the following reaction:



In this reaction, the  $\text{I}_2$  atoms undergo:

- A. oxidation only
- B. both oxidation and reduction
- C. reduction only
- D. neither oxidation nor reduction

\_\_\_ 13. In an electrochemical cell, electrons flow from the

- A. anode to the cathode through the salt bridge
- B. anode to cathode through the external circuit
- C. cathode to the anode through the salt bridge
- D. cathode to anode through the external circuit

14. Explain your answer to the question above:

\_\_\_ 15. When molten aluminum oxide is electrolyzed, the cathode reaction is:

- A.  $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$
- B.  $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$
- C.  $\text{O}_2 + 4\text{e}^- \rightarrow 2\text{O}^{2-}$
- D.  $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$

\_\_\_ 16. Gold is found in nature in its pure form because:

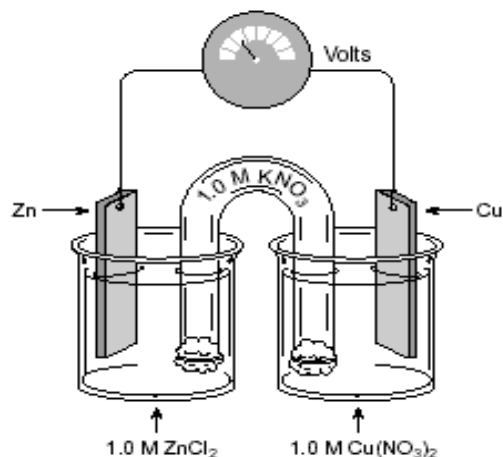
- A.  $\text{Au}^{3+}$  is a strong reducing agent
- B.  $\text{Au}^{3+}$  a strong oxidizing agent
- C. Au is a strong reducing agent
- D. Au is a strong oxidizing agent

17. Explain your answer to the question above:

\_\_\_ 18. The electrolysis of  $\text{Na}_2\text{SO}_4(\text{aq})$  would produce this gas at the anode.

- A. Oxygen
- B. Hydrogen
- C. Water vapour
- D. Sulfur dioxide

Use the following cell diagram for questions 19 and 20.



\_\_\_ 19. In the above electrochemical cell,

- A. the mass of the anode increases and the mass of the cathode increases.
- B. the mass of the anode decreases and the mass of the cathode decreases.
- C. the mass of the anode decreases and the mass of the cathode increases.
- D. the mass of the anode increases and the mass of the cathode decreases.

\_\_\_ 20. In the above electrochemical cell,

- A. The anode is Zn and the cathode is Cu
- B. The anode is Cu and the cathode is Zn
- C. The anode is  $\text{Zn}^{2+}$  and the cathode is  $\text{Cu}^{2+}$
- D. The anode is  $\text{Cu}^{2+}$  and the cathode is  $\text{Zn}^{2+}$

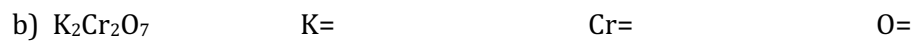
\_\_\_ 21. In the operating electrochemical cell above, the voltage produced is:

- A. -1.10 V
- B. -0.42 V
- C. 0.00 V
- D. +1.10 V

22. Explain your answer to the question above:

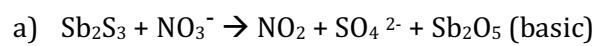
## II. Problems

1) For each of the following compounds, identify the oxidation number of the atom(s) indicated.

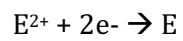
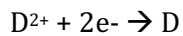
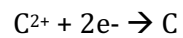
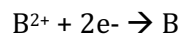
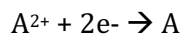


2) A  $\text{Mn}/\text{Mn}^{2+}$  and  $\text{Ag}^+/\text{Ag}$  electrochemical cell is set up at standard conditions. Draw the electrochemical cell for this particular reaction. Label all parts of the cell, including the voltage produced.

3) Balance the following redox reactions.



4) You have been given the following five half-reactions:



- $B^{2+}$  reacted with A.
- $E^{2+}$  did not react with C.
- $D^{2+}$  only reacted with B and A.

Given the above information, create an SRP table:

5) For each of the following, draw the electrolytic cell, including the half-reactions occurring within it:

a) Platinum electrodes in molten  $MgBr_2$

b) Copper electrodes in  $NaCl_{(aq)}$