ALBERTA CHEMISTRY 30 · UNIT B · 25 QUESTIONS

Electrochemical Changes — Practice Test

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, use the Flag a mistake button to let Brett know so he can fix it.

1 **The oxidation number of manganese in $KMnO_4(s)$ is**

- A +2
- B +5
- C +7
- D -7

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2 **In the reaction represented by the equation**
$Mg(s) + 2\ HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$
the species that is oxidized is

- **A** $Mg(s)$
- **B** $H^+(aq)$
- **C** $Cl^-(aq)$
- **D** $H_2(g)$

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3 **In the reaction represented by the equation**
$2\ Fe^{2+}(aq) + Cl_2(g) \rightarrow 2\ Fe^{3+}(aq) + 2\ Cl^-(aq)$
the reducing agent is

- **A** $Cl_2(g)$
- **B** $Fe^{2+}(aq)$
- **C** $Fe^{3+}(aq)$
- **D** $Cl^-(aq)$

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4 **Which of the following equations represents a redox reaction?**

- **A** $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$
- **B** $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
- **C** $Zn(s) + 2\ HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$
- **D** $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

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5 **The oxidation number of nitrogen in $HNO_2(aq)$ is +____ Record the single digit that completes the oxidation number.**

ANSWER _____

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6

Use the following standard reduction potentials to answer this question.

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$ E° = +0.80 V

$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$ E° = +0.34 V

$Ni^{2+}(aq) + 2e^{-} \rightarrow Ni(s)$ E° = -0.26 V

$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s)$ E° = -0.76 V

The strongest oxidizing agent among these is

A $Ni^{2+}(aq)$

B $Zn^{2+}(aq)$

C $Cu^{2+}(aq)$

D $Ag^{+}(aq)$

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7

Use the following standard reduction potentials to answer this question.

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$ E° = +0.80 V

$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$ E° = +0.34 V

$Ni^{2+}(aq) + 2e^{-} \rightarrow Ni(s)$ E° = -0.26 V

$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s)$ E° = -0.76 V

Which of the following reactions is spontaneous under standard conditions?

A $Cu(s) + Zn^{2+}(aq) \rightarrow Cu^{2+}(aq) + Zn(s)$

B $Zn(s) + Ni^{2+}(aq) \rightarrow Zn^{2+}(aq) + Ni(s)$

C $Ni(s) + Zn^{2+}(aq) \rightarrow Ni^{2+}(aq) + Zn(s)$

D $Ag(s) + Cu^{2+}(aq) \rightarrow Ag^{+}(aq) + Cu(s)$

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8 **A voltaic cell is constructed from the following half reactions.**

$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ E° = -0.74 V

$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$ E° = -0.14 V

The standard cell potential, $E°c_{ell}$, is

- A +0.60 V
- B +0.88 V
- C -0.60 V
- D -0.88 V

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9 **An electrolytic cell contains aqueous copper(II) sulfate and inert electrodes. The reaction that occurs at the cathode is**

- A $2\ H_2O(l) + 2e^- \rightarrow H_2(g) + 2\ OH^-(aq)$
- B $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$
- C $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$
- D $2\ H_2O(l) \rightarrow O_2(g) + 4\ H^+(aq) + 4e^-$

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10 **A voltaic cell is based on the half reactions**

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ $E° = -0.45$ V

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ $E° = +0.34$ V

The value of $E°_{cell}$, in volts, is

ANSWER

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11 **When the half reaction**

$MnO_4^-(aq) \rightarrow Mn^{2+}(aq)$

is balanced in acidic solution using the lowest whole number coefficients, the coefficient of $H^+(aq)$ is

A 4

B 5

C 10

D 8

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12 **Hydrogen peroxide decomposes according to the equation**

$2\ H_2O_2(aq) \rightarrow 2\ H_2O(l) + O_2(g)$

In this reaction, the oxygen in hydrogen peroxide is

A oxidized only

B reduced only

C both oxidized and reduced

D neither oxidized nor reduced

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13 **A 20.00 mL sample of $Fe^{2+}(aq)$ is titrated with 0.0100 mol/L $KMnO_4(aq)$ in acidic solution. The graph shows the cell potential during the titration.**

$MnO_4^-(aq) + 5\ Fe^{2+}(aq) + 8\ H^+(aq) \rightarrow Mn^{2+}(aq) + 5\ Fe^{3+}(aq) + 4\ H_2O(l)$

The concentration of the $Fe^{2+}(aq)$ solution is

A 0.00800 mol/L

B 0.0400 mol/L

C 0.200 mol/L

D 0.00160 mol/L

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14 **A current of 2.50 A is passed through molten aluminum chloride for 30.0 min.**
The half reaction is $Al^{3+}(l) + 3e^- \rightarrow Al(l)$, and $F = 9.65 \times 10^4$ C/mol e^-, with the molar mass of aluminum equal to 26.98 g/mol. The mass of aluminum produced, in grams, is

ANSWER _____

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15 **The graph shows the mass of silver plated during electroplating over time. The mass of silver plated after 45 minutes is**

A 1.20 g

B 2.40 g

C 3.60 g

D 4.80 g

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16 **In an operating voltaic cell,**

A electrons flow through the external circuit from the cathode to the anode

B cations in the salt bridge migrate toward the cathode

C oxidation occurs at the cathode

D the anode is the positive electrode

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17 **The standard reduction potential of $Cu^{2+}(aq)/Cu(s)$ is +0.34 V when the standard hydrogen electrode is assigned a potential of 0.00 V. If the hydrogen electrode were instead assigned +0.50 V, the reduction potential of $Cu^{2+}(aq)/Cu(s)$ would be**

A -0.16 V

B +0.34 V

C +1.18 V

D +0.84 V

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18 **When the equation**
$Cr_2O_7^{2-}(aq) + Fe^{2+}(aq) + H^+(aq) \rightarrow Cr^{3+}(aq) + Fe^{3+}(aq) + H_2O(l)$
is balanced using the lowest whole number coefficients, the coefficient of $H_2O(l)$ is

ANSWER _____

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19 **The graph shows the mass of the cathode during electroplating over time. The mass of the cathode after 20 minutes, in grams, is ____.**

ANSWER _____

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20 **Use the following standard reduction potentials.**

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$ $E° = +0.80$ V

$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$ $E° = +0.34$ V

$Ni^{2+}(aq) + 2e^{-} \rightarrow Ni(s)$ $E° = -0.26$ V

$Fe^{2+}(aq) + 2e^{-} \rightarrow Fe(s)$ $E° = -0.45$ V

$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s)$ $E° = -0.76$ V

An aqueous solution of copper(II) sulfate could be stored without reacting in a container made of

- **A** Zn(s)
- **B** Fe(s)
- **C** Ni(s)
- **D** Ag(s)

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21 **A voltaic cell is based on the reduction of $X^{2+}(aq)$ at the cathode and the oxidation of tin at the anode, where $Sn^{2+}(aq) + 2e^{-} \rightarrow Sn(s)$ has $E° = -0.14$ V. If $E°_{cell} = +0.59$ V, then the standard reduction potential of $X^{2+}(aq)/X(s)$, in volts, is**

ANSWER _____

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22 **The graph shows the potential of a voltaic cell over time as it operates. The potential of the cell after 6 hours is**

A 1.10 V

B 0.80 V

C 0.20 V

D 0.00 V

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23 **In the reaction represented by the equation**
$3\ Cu(s) + 8\ HNO_3(aq) \rightarrow 3\ Cu(NO_3)_2(aq) + 2\ NO(g) + 4\ H_2O(l)$
the total number of moles of electrons transferred when 3 mol of copper reacts is

ANSWER _____

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24 **The graph shows the mass of the anode during electrolysis over time. The mass of the anode after 20 minutes, in grams, is ____.**

ANSWER _____

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25

A 25.00 mL sample of hydrogen peroxide solution is titrated with 0.0150 mol/L $KMnO_4(aq)$ in acidic solution, and the endpoint is reached at 22.40 mL.

$2\ MnO_4^-(aq) + 5\ H_2O_2(aq) + 6\ H^+(aq) \rightarrow 2\ Mn^{2+}(aq) + 5\ O_2(g) + 8\ H_2O(l)$

The concentration of the hydrogen peroxide solution, in mol/L, is

ANSWER

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ANSWER KEY

1. C
2. A
3. B
4. C
5. 3
6. D
7. B
8. A
9. B
10. 0.79
11. D
12. C
13. B
14. 0.419
15. C
16. B
17. D
18. 7
19. 12.0
20. D
21. 0.45
22. B
23. 6
24. 8.0
25. 0.0336

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