Tables for Oxidation Reduction

1. Consider the following reactions.

**Ce3+(aq) + 3e- 🡪 Ce(s) Eo = -2.34 V**

**Cr2+(aq) + 2e- 🡪 Cr(s) Eo = -0.91 V**

When a spontaneous electrochemical cell is constructed on the basis of the following two half-reactions, the oxidizing agents will gain \_\_\_\_\_\_.

|  |  |
| --- | --- |
| a | six less electrons than the reducing agent gains |
| b | two more electrons than the reducing agent loses |
| c | three more electrons than the reducing agent loses |
| d | the same number of electrons as the reducing agent loses |

1. Consider the following reactions.

**Cl2(g) + 2e-  🡪 2Cl-(aq) Eo = 1.36 V**

**Fe3+(aq) + e- 🡪 Fe2+(aq) Eo = 0.77 V**

 **Cr2+(aq) 🡪 Cr3+(aq) + e- Eo = 0.41V**

**Zn2+(aq) + 2e- 🡪 Zn(s) Eo = -0.76 V**

Which chemical species loses electrons?

|  |  |
| --- | --- |
| a | Cl2(g) |
| b | Fe3+(aq) |
| c | Cr2+(aq) |
| d | Zn2+(aq) |

1. Which half-reaction has a negative Eo value?

|  |  |
| --- | --- |
| a | Fe2+(aq) 🡪 Fe3+(aq) + e- |
| b | Br2(l) + 2e- 🡪 2Br-(aq) |
| c | Au3+(aq) + 3e-🡪 Au(s) |
| d | Cr(s) 🡪 Cr2+(aq) + 2e- |

1. Which of these would react spontaneously with Co(s) but **NOT** with H2(g)?

|  |  |
| --- | --- |
| a | H2O(l) |
| b | Ni2+(aq) |
| c | Ca2+(aq) |
| d | Br-(aq) |

1. Brad and Charles observed the reactions between four different metals and the solutions of their metallic ions. The boys recorded these "spontaneous" reactions.

|  |  |
| --- | --- |
| **Reaction** |  |
| **I** | **W(s) + X+(aq) 🡪 W+(aq) + X(s)** |
| **II** | **X(s) + Y+(aq) 🡪 X+(aq) + Y(s)** |
| **III** | **Y(s) + Z+(aq) 🡪 Y+(aq) + Z(s)** |
| **IV** | **Z(s) + W+(aq) 🡪 Z+(aq) + W(s)** |
| **V** | **X(s) + Z+(aq) 🡪 X+(aq) + Z(s)** |

If **equation I** is correct, which equation did the student record **incorrectly**?

|  |  |
| --- | --- |
| a | II |
| b | III |
| c | IV |
| d | V |

1. Consider the following reactions.

**2A+(aq) + Mg(s) 🡪 Mg2+(aq) + 2A(s) Eo = 2.60 V**

**B(s) + Cd2+(aq) 🡪 Cd(s) + B2+(aq) Eo = 0.63 V**

The Eo for the reaction 2A+(aq) + B(s) 🡪 B2+(aq) + 2A(s) is \_\_\_\_\_\_\_ V

|  |  |
| --- | --- |
| a | 3.23 |
| b | 1.97 |
| c | 1.26 |
| d | 0.80 |

1. Consider the following reactions

|  |  |
| --- | --- |
| **Ir(s) +3 Tl+(aq) 🡪 Ir3+(aq) + 3Tl(s)** | **Negative Eo** |
| **Ir3+(aq) + Rh(s) 🡪 Ir(s) + Rh3+(aq)** | **Negative Eo** |
| **3Tl+(aq) + Y(s) 🡪 3Tl(s) + Y3+(aq)** | **Positive Eo** |

In these reactions, the **strongest oxidizing agent** is \_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | Tl-(aq) |
| b | Y3+(aq) |
| c | Ir3+(aq) |
| d | Rh3+(aq) |

1. Consider the following reaction

**Cu2+(aq) + X(s) 🡪 Cu(s) +X2+(aq) Eo = 1.10 V**

Element X(s) is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | Al(s) |
| b | Ca(s) |
| c | Zn(s) |
| d | Ag(s) |

1. Which process could cause X2-(aq) to change to X-(aq)?

|  |  |
| --- | --- |
| a | Z(s) 🡪 Z3-(aq) |
| b | Z(s) 🡪 Z3+(aq) |
| c | Z2-(aq) 🡪 Z(s) |
| d | Z3-(aq) 🡪 Z(s) |

1. The reaction A2+(aq) + X(s) 🡪 A(s) + X2+(aq) proceeds spontaneously.

The elements A(s) and X(s) could be \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_respectively.

|  |  |  |
| --- | --- | --- |
| a | Cr(s) | Co(s) |
| b | Pb(s)  | Cu(s) |
| c | Co(s) | Cu(s) |
| d | Ni(s)  | Zn(s) |

1. The substance that would oxidize Fe(s) to Fe2+(aq) in a neutral solution is \_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | AgNO3(aq) |
| b | NaNO3(aq) |
| c | LiNO3(aq) |
| d | KNO3(aq) |

1. Which reactants will result in a **spontaneous reaction**?

|  |  |
| --- | --- |
| a | Fe2+(aq) + Pb2+(aq) |
| b | Cr2+(aq) + Zn2+(aq) |
| c | Sn2+(aq) + I2(s) |
| d | Na+(aq) + Ni(s) |

1. Consider the oxidation potential table given below.

|  |  |
| --- | --- |
| **C(s) 🡪 C3+(aq) + 3e-** | **Eo = +1.80 V** |
| **D(l) 🡪 D2+(aq) + 2e-** | **Eo = +0.35 V** |
| **A2+(aq) 🡪 A4+(aq) + 2e-** | **Eo =-0.25 V** |
| **2B-(aq) 🡪 B2(g) + 2e-** | **Eo = -1.25 V** |

The strongest **oxidizing agent** in this table is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | C(s) |
| b | B2(g) |
| c | A4+(aq) |
| d | D2+(aq) |

1. Zinc metal will not spontaneously act as a reducing agent for which group of chemical agents?

|  |  |
| --- | --- |
| a | Fe2+(aq) , H+(aq), Cu2+(aq) |
| b | Co2+(aq), Sn2+(aq), Pb2+(aq) |
| c | Cu2+(aq), Hg2+(aq), Br2(l) |
| d | Ca2+(aq), Na+(aq), Mn2+(aq) |

1. The standard electrode potential for the conversion of Sn2+(aq) to Sn4+(aq) is \_\_\_ V

|  |  |
| --- | --- |
| a | +0.15  |
| b | -0.14 |
| c | -0.15 |
| d | +0.14 |

1. Consider the following **spontaneous reactions,**

|  |
| --- |
| **X2+(aq) +Y(s) 🡪 Y2+(aq) + X(s)** |
| **X2+(aq) + Q(s) 🡪 X(s) + Q2+(aq)** |
| **Y2+(aq) + Z(s) 🡪 Y(s) + Z2+(aq)** |
| **Z2+(aq) + Q(s) 🡪 Z(s) + Q2+(aq)** |

Based on this information, the **strongest oxidizing agent** is \_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | Q2+(aq) |
| b | X2+(aq) |
| c | Z2+(aq) |
| d | Y2+(aq) |

1. Consider the following **spontaneous reactions,**

|  |
| --- |
| **X2+(aq) +Y(s) 🡪 Y2+(aq) + X(s)** |
| **X2+(aq) + Q(s) 🡪 X(s) + Q2+(aq)** |
| **Y2+(aq) + Z(s) 🡪 Y(s) + Z2+(aq)** |
| **Z2+(aq) + Q(s) 🡪 Z(s) + Q2+(aq)** |

Based on this information, the **strongest reducing agent** is \_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | Q(s) |
| b | X (s) |
| c | Z(s) |
| d | Y(s) |

1. Given the reaction 2NO3-(aq) + 4H+(aq) + X(s) 🡪 2H2O(l) + N2O4(g) + X2+(aq) Eo = +2.18 V

The standard electrode potential for the half-reaction X2+(aq) + 2e- 🡪 X(s) is \_\_\_ V

|  |  |
| --- | --- |
| a | +2.98 |
| b | +1.38 |
| c | -1.38 |
| d | -2.98 |

1. Given the reaction 2NO3-(aq) + 4H+(aq) + X(s) 🡪 2H2O(l) + N2O4(g) + X2+(aq) Eo = +2.18 V

The standard electrode potential for the half-reaction **X(s) 🡪X2+(aq) + 2e-** is \_\_\_ V

|  |  |
| --- | --- |
| a | +2.98 |
| b | +1.38 |
| c | -1.38 |
| d | -2.98 |

1. Which process listed below could NOT cause M3+(aq) to change to M­2(g)

|  |  |
| --- | --- |
| a | R(s) 🡪 R2-(aq) |
| b | D2- (aq) 🡪 D+(aq) |
| c | T-(aq) 🡪 T(s) |
| d | L3-(aq) 🡪 L-(aq) |

1. A true statement that can be made from a reading of the standard electrode potentials table is that \_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | silver bromide gains electrons more readily than hydrogen ions do |
| b | hydrogen ions gain electrons more readily than silver bromide do |
| c | hydrogen gas loses electrons more readily than cadmium metal do |
| d | hydrogen gas gains electrons more readily than silver bromide do |

1. Jason and Cliff use the following data to build a reduction table.

|  |  |
| --- | --- |
| L+ + Z- 🡪 L + Z | Spontaneous reaction |
| Q2+ + 2Z- 🡪 Z + 2Z | Spontaneous reaction |
| M3+ + 3Z- 🡪 M + 3Z | Non spontaneous reaction |
| 2L+ + Q 🡪 2L + Q2+  | Non spontaneous reaction |

The strongest oxidizing agent in their table will be \_\_\_\_\_\_

|  |  |
| --- | --- |
| a | Z |
| b | Q2+ |
| c | M3+ |
| d | L+ |

1. Jason and Cliff use the following data to build a reduction table.

|  |  |
| --- | --- |
| L+ + Z- 🡪 L + Z | Spontaneous reaction |
| Q2+ + 2Z- 🡪 Z + 2Z | Spontaneous reaction |
| M3+ + 3Z- 🡪 M + 3Z | Non spontaneous reaction |
| 2L+ + Q 🡪 2L + Q2+  | Non spontaneous reaction |

The strongest reducing agent will be \_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | Z- |
| b | Q |
| c | M |
| d | L |

1. Sue and Amy use the following data to build a reduction table. Each reaction is listed as spontaneous or non spontaneous.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R3+ | J | X2+ | L+ |
| R2+ | Non spontaneous | Spontaneous | Non spontaneous | Non spontaneous |
| J- | Non spontaneous | Non spontaneous | Non spontaneous | Non spontaneous |
| X | Spontaneous | Spontaneous  | Non spontaneous | Non spontaneous |
| L | Spontaneous | Spontaneous | Spontaneous | Non spontaneous |

The oxidizing agents, listed from the strongest to the weakest will be \_\_\_, \_\_\_\_, \_\_\_\_, and \_\_\_\_.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a | L+ | X2+ | R3+ | J |
| b | J- | R2+ | X | L |
| c | L | X | R2+ | J- |
| d | J | R3+ | X2+ | L+ |

1. Sue and Amy use the following data to build a reduction table. Each reaction is listed as spontaneous or non spontaneous.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R3+ | J | X2+ | L+ |
| R2+ | Non spontaneous | Spontaneous | Non spontaneous | Non spontaneous |
| J- | Non spontaneous | Non spontaneous | Non spontaneous | Non spontaneous |
| X | Spontaneous | Spontaneous  | Non spontaneous | Non spontaneous |
| L | Spontaneous | Spontaneous | Spontaneous | Non spontaneous |

The **reducing agents**, listed from the **strongest to the weakest** will be \_\_\_, \_\_\_\_, \_\_\_\_, and \_\_\_\_.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a | L+ | X2+ | R3+ | J |
| b | J- | R2+ | X | L |
| c | L | X | R2+ | J- |
| d | J | R3+ | X2+ | L+ |

1. **Numerical response question** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Students make the following observations for a series of electrochemical cells

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | 5 | 6 | 7 | 8 |
|  |  | Be2+ | Cd2+ | Ra2+ | V2+ |
| 1 | Be(s) | x |  | x |  |
| 2 | Cd(s) | x | x | x | x |
| 3 | Ra(s) |  |  | x |  |
| 4 | V(s) | x |  | x | x |

* Indicates a spontaneous reaction

X Indicates a non-spontaneous reactionUsing the assigned numbers from 1 to 8, list the **oxidizing agents** in order from strongest to weakest.  \_\_\_, \_\_\_, \_\_\_, \_\_\_ |

1. **Numerical response question** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Students make the following observations for a series of electrochemical cells

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | 1 | 2 | 3 | 4 |
|  |  | A+(aq) | B+(aq) | C+(aq) | D+(aq) |
| 5 | A(s) | x |  | x |  |
| 6 | B(s) | x | x | x | x |
| 7 | C(s) |  |  | x |  |
| 8 | D(s) | x |  | x | x |

* Indicates a spontaneous reaction

X Indicates a non-spontaneous reactionUsing the assigned numbers from 1 to 8, list the **reducing agents** in order from **strongest to weakest.**  \_\_\_, \_\_\_, \_\_\_, \_\_\_ |
| 1. **Numerical response question** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

Students make the following observations for a series of electrochemical cells

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | 1 | 2 | 3 | 4 |
|  |  | A+(aq) | B+(aq) | C+(aq) | D+(aq) |
| 5 | A(s) | x | x | x |  |
| 6 | B(s) |  | x |  |  |
| 7 | C(s) |  |  x | x |  |
| 8 | D(s) | x |  x | x | x |

* Indicates a spontaneous reaction

X Indicates a non-spontaneous reactionUsing the assigned numbers from 1 to 8, list the **reducing agents** in order from **strongest to weakest**.  \_\_\_, \_\_\_, \_\_\_, \_\_\_ |
| 1. **Numerical response question** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

Consider the following half reactions:

|  |  |  |
| --- | --- | --- |
| Number | Half reaction | voltage |
| 1 | Fe2+(aq) + 2e- 🡪 Fe(s) | Eo = -0.45 V |
| 2 | Br2(l) + 2e- 🡪 2Br-(aq) | Eo = +1.07 V |
| 3 | Au3+(aq) + 3e- 🡪 Au(s) | Eo = +1.50 V |
| 4 | Li+(aq) + e- 🡪 Li(s) | Eo = -3.04 V |

List the **oxidizing agents** from **weakest to strongest:** \_\_\_, \_\_\_, \_\_\_, \_\_\_1. **Numerical response question** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

 |
| Calculate the cell potential for the following oxidation - reduction reaction. 3Cd2+(aq) + 2Al(s) 🡪 2Al3+(aq) + 3Cd(s)Express the answer as shown below:“+” select 1“-“ select 2 \_\_\_\_\_ . \_\_\_\_\_ \_\_\_\_\_box 1 box 2 box 3 box 4 |
| 1. **Numerical response question** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

The cell potential for the oxidation - reduction reaction represented by the two half reactions given below is \_\_\_\_\_\_\_ VAu3+(aq) + 3e- 🡪 Au(s)Al(s) 🡪 Al3+(aq) + 3 e- |
|  |

Solutions:

1. D
2. C
3. A
4. B
5. C
6. C
7. D
8. C
9. A
10. D
11. A
12. C
13. B
14. D
15. C
16. B
17. A
18. C
19. b
20. A
21. A
22. B
23. C
24. D
25. C
26. 6857
27. 7586
28. 6758
29. 4123
30. 1126
31. 3.16