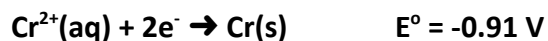
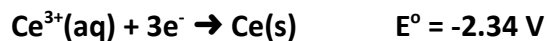


Tables for Oxidation Reduction

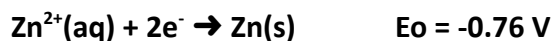
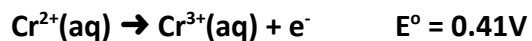
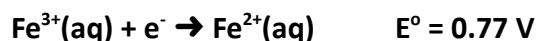
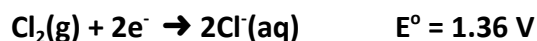
1. Consider the following reactions.



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

2. Consider the following reactions.



Which chemical species loses electrons?

a	$\text{Cl}_2(\text{g})$
b	$\text{Fe}^{3+}(\text{aq})$
c	$\text{Cr}^{2+}(\text{aq})$
d	$\text{Zn}^{2+}(\text{aq})$

3. Which half-reaction has a negative E° value?

a	$\text{Fe}^{2+}(\text{aq}) \rightarrow \text{Fe}^{3+}(\text{aq}) + \text{e}^{-}$
b	$\text{Br}_2(\text{l}) + 2\text{e}^{-} \rightarrow 2\text{Br}^{-}(\text{aq})$
c	$\text{Au}^{3+}(\text{aq}) + 3\text{e}^{-} \rightarrow \text{Au}(\text{s})$
d	$\text{Cr}(\text{s}) \rightarrow \text{Cr}^{2+}(\text{aq}) + 2\text{e}^{-}$

4. Which of these would react spontaneously with $\text{Co}(\text{s})$ but **NOT** with $\text{H}_2(\text{g})$?

a	$\text{H}_2\text{O}(\text{l})$
b	$\text{Ni}^{2+}(\text{aq})$
c	$\text{Ca}^{2+}(\text{aq})$
d	$\text{Br}^{-}(\text{aq})$

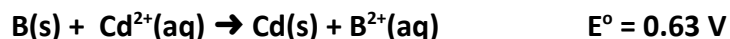
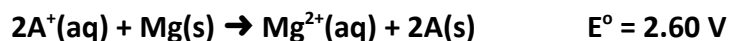
5. Brad and Charles observed the reactions between four different metals and the solutions of their metallic ions. The boys recorded these "spontaneous" reactions.

Reaction	
I	$W(s) + X^+(aq) \rightarrow W^+(aq) + X(s)$
II	$X(s) + Y^+(aq) \rightarrow X^+(aq) + Y(s)$
III	$Y(s) + Z^+(aq) \rightarrow Y^+(aq) + Z(s)$
IV	$Z(s) + W^+(aq) \rightarrow Z^+(aq) + W(s)$
V	$X(s) + Z^+(aq) \rightarrow X^+(aq) + Z(s)$

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

a	II
b	III
c	IV
d	V

6. Consider the following reactions.



The E° for the reaction $2A^+(aq) + B(s) \rightarrow B^{2+}(aq) + 2A(s)$ is _____ V

a	3.23
b	1.97
c	1.26
d	0.80

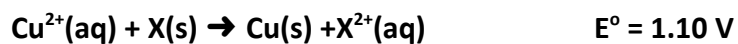
7. Consider the following reactions

$Ir(s) + 3 TI^+(aq) \rightarrow Ir^{3+}(aq) + 3TI(s)$	Negative E°
$Ir^{3+}(aq) + Rh(s) \rightarrow Ir(s) + Rh^{3+}(aq)$	Negative E°
$3TI^+(aq) + Y(s) \rightarrow 3TI(s) + Y^{3+}(aq)$	Positive E°

In these reactions, the **strongest oxidizing agent** is _____

a	$TI^+(aq)$
b	$Y^{3+}(aq)$
c	$Ir^{3+}(aq)$
d	$Rh^{3+}(aq)$

8. Consider the following reaction



Element X(s) is _____

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

9. Which process could cause $\text{X}^{2+}(\text{aq})$ to change to $\text{X}(\text{aq})$?

a	$\text{Z}(\text{s}) \rightarrow \text{Z}^{3+}(\text{aq})$
b	$\text{Z}(\text{s}) \rightarrow \text{Z}^{3+}(\text{aq})$
c	$\text{Z}^{2+}(\text{aq}) \rightarrow \text{Z}(\text{s})$
d	$\text{Z}^{3+}(\text{aq}) \rightarrow \text{Z}(\text{s})$

10. The reaction $\text{A}^{2+}(\text{aq}) + \text{X}(\text{s}) \rightarrow \text{A}(\text{s}) + \text{X}^{2+}(\text{aq})$ 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)

11. The substance that would oxidize Fe(s) to $\text{Fe}^{2+}(\text{aq})$ in a neutral solution is _____

a	$\text{AgNO}_3(\text{aq})$
b	$\text{NaNO}_3(\text{aq})$
c	$\text{LiNO}_3(\text{aq})$
d	$\text{KNO}_3(\text{aq})$

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

a	$\text{Fe}^{2+}(\text{aq}) + \text{Pb}^{2+}(\text{aq})$
b	$\text{Cr}^{2+}(\text{aq}) + \text{Zn}^{2+}(\text{aq})$
c	$\text{Sn}^{2+}(\text{aq}) + \text{I}_2(\text{s})$
d	$\text{Na}^+(\text{aq}) + \text{Ni}(\text{s})$

13. Consider the oxidation potential table given below.

$\text{C(s)} \rightarrow \text{C}^{3+}(\text{aq}) + 3\text{e}^-$	$E^\circ = +1.80 \text{ V}$
$\text{D(l)} \rightarrow \text{D}^{2+}(\text{aq}) + 2\text{e}^-$	$E^\circ = +0.35 \text{ V}$
$\text{A}^{2+}(\text{aq}) \rightarrow \text{A}^{4+}(\text{aq}) + 2\text{e}^-$	$E^\circ = -0.25 \text{ V}$
$2\text{B}^-(\text{aq}) \rightarrow \text{B}_2(\text{g}) + 2\text{e}^-$	$E^\circ = -1.25 \text{ V}$

The strongest **oxidizing agent** in this table is _____

a	C(s)
b	$\text{B}_2(\text{g})$
c	$\text{A}^{4+}(\text{aq})$
d	$\text{D}^{2+}(\text{aq})$

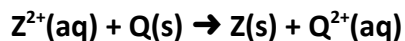
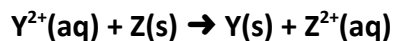
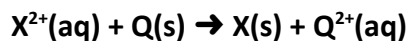
14. Zinc metal will not spontaneously act as a reducing agent for which group of chemical agents?

a	$\text{Fe}^{2+}(\text{aq}), \text{H}^+(\text{aq}), \text{Cu}^{2+}(\text{aq})$
b	$\text{Co}^{2+}(\text{aq}), \text{Sn}^{2+}(\text{aq}), \text{Pb}^{2+}(\text{aq})$
c	$\text{Cu}^{2+}(\text{aq}), \text{Hg}^{2+}(\text{aq}), \text{Br}_2(\text{l})$
d	$\text{Ca}^{2+}(\text{aq}), \text{Na}^+(\text{aq}), \text{Mn}^{2+}(\text{aq})$

15. The standard electrode potential for the conversion of $\text{Sn}^{2+}(\text{aq})$ to $\text{Sn}^{4+}(\text{aq})$ is ____ V

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

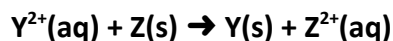
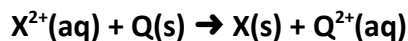
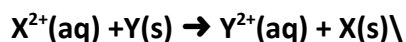
16. Consider the following **spontaneous reactions**,



Based on this information, the **strongest oxidizing agent** is _____

a	$\text{Q}^{2+}(\text{aq})$
b	$\text{X}^{2+}(\text{aq})$
c	$\text{Z}^{2+}(\text{aq})$
d	$\text{Y}^{2+}(\text{aq})$

17. Consider the following **spontaneous reactions**.



Based on this information, the **strongest reducing agent** is _____

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

18. Given the reaction $2NO_3^-(aq) + 4H^+(aq) + X(s) \rightarrow 2H_2O(l) + N_2O_4(g) + X^{2+}(aq)$ $E^\circ = +2.18\text{ V}$

The standard electrode potential for the half-reaction $X^{2+}(aq) + 2e^- \rightarrow X(s)$ is ____ V

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

19. Given the reaction $2NO_3^-(aq) + 4H^+(aq) + X(s) \rightarrow 2H_2O(l) + N_2O_4(g) + X^{2+}(aq)$ $E^\circ = +2.18\text{ V}$

The standard electrode potential for the half-reaction $X(s) \rightarrow X^{2+}(aq) + 2e^-$ is ____ V

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

20. Which process listed below could NOT cause $M^{3+}(aq)$ to change to $M_2(g)$

a	$R(s) \rightarrow R^{2-}(aq)$
b	$D^{2-}(aq) \rightarrow D^+(aq)$
c	$T(aq) \rightarrow T(s)$
d	$L^{3-}(aq) \rightarrow L^-(aq)$

21. 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

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

$L^+ + Z^- \rightarrow L + Z$	Spontaneous reaction
$Q^{2+} + 2Z^- \rightarrow Z + 2Z$	Spontaneous reaction
$M^{3+} + 3Z^- \rightarrow M + 3Z$	Non spontaneous reaction
$2L^+ + Q \rightarrow 2L + Q^{2+}$	Non spontaneous reaction

The strongest oxidizing agent in their table will be _____

a	Z
b	Q^{2+}
c	M^{3+}
d	L^+

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

$L^+ + Z^- \rightarrow L + Z$	Spontaneous reaction
$Q^{2+} + 2Z^- \rightarrow Z + 2Z$	Spontaneous reaction
$M^{3+} + 3Z^- \rightarrow M + 3Z$	Non spontaneous reaction
$2L^+ + Q \rightarrow 2L + Q^{2+}$	Non spontaneous reaction

The strongest reducing agent will be _____

a	Z^-
b	Q
c	M
d	L

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

	R^{3+}	J	X^{2+}	L^+
R^{2+}	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^+	X^{2+}	R^{3+}	J
b	J^-	R^{2+}	X	L
c	L	X	R^{2+}	J^-
d	J	R^{3+}	X^{2+}	L^+

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

	R^{3+}	J	X^{2+}	L^+
R^{2+}	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^+	X^{2+}	R^{3+}	J
b	J^-	R^{2+}	X	L
c	L	X	R^{2+}	J^-

d	J	R ³⁺	X ²⁺	L ⁺
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26. **Numerical response question** Left justify your answer in the boxes provided.

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Students make the following observations for a series of electrochemical cells

		5	6	7	8
		Be ²⁺	Cd ²⁺	Ra ²⁺	V ²⁺
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 reaction

Using the assigned numbers from 1 to 8, list the **oxidizing agents** in order from strongest to weakest.

____, _____, _____, _____

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

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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 reaction

Using the assigned numbers from 1 to 8, list the **reducing agents** in order from **strongest to weakest**.

____, ____, ____, ____

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

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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 reaction

Using the assigned numbers from 1 to 8, list the **reducing agents** in order from **strongest to weakest**.

____, ____, ____, ____

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

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Consider the following half reactions:

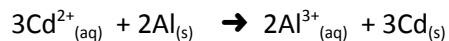
Number	Half reaction	voltage
1	$Fe^{2+}_{(aq)} + 2e^- \rightarrow Fe_{(s)}$	$E^0 = -0.45 \text{ V}$
2	$Br_{2(l)} + 2e^- \rightarrow 2Br^-_{(aq)}$	$E^0 = +1.07 \text{ V}$
3	$Au^{3+}_{(aq)} + 3e^- \rightarrow Au_{(s)}$	$E^0 = +1.50 \text{ V}$
4	$Li^+_{(aq)} + e^- \rightarrow Li_{(s)}$	$E^0 = -3.04 \text{ V}$

List the **oxidizing agents** from **weakest to strongest**: ____, ____, ____, ____

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

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Calculate the cell potential for the following oxidation - reduction reaction.



Express the answer as shown below:

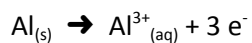
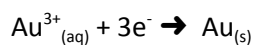
"+" select 1

"-" select 2 .
box 1 box 2 box 3 box 4

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

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The cell potential for the oxidation - reduction reaction represented by the two half reactions given below is _____ V



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