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Unit 11 Practice Test**Part A**

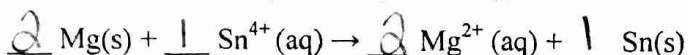
- During which process does an atom gain one or more electrons?
 - Transmutation
 - Oxidation
 - ☒ Reduction
 - Neutralization
- In the formula X_2O_5 , the symbol X could represent an element in Group
 - 1
 - 2
 - ☒ 15
 - 18
- What is the oxidation number of sulfur in $Na_2S_2O_3$?
 - 1
 - +2
 - +6
 - ☒ +4
- Which balanced equation represents a redox reaction?
 - ☒ $PCl_5 \rightarrow PCl_3 + Cl_2$
 - $KOH + HCl \rightarrow KCl + H_2O$
 - $LiBr \rightarrow Li^{1+} + Br^{1-}$
 - $Ca^{2+} + SO_4^{2-} \rightarrow CaSO_4$
- In a redox reaction, the total number of electrons lost is
 - less than the total number of electrons gained
 - greater than the total number of electrons gained
 - ☒ equal to the total number of electrons gained
 - equal to the total number of protons gained
- Given the balanced equation representing a reaction:

$$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$$
 The oxidation state of chlorine in this reaction changes from
 - 1 to +1
 - +1 to -1
 - 1 to +5
 - ☒ +5 to -1
- Which half-reaction equation represents the reduction of a potassium ion?
 - ☒ $K^{1+} + e^- \rightarrow K$
 - $K + e^- \rightarrow K^{1+}$
 - $K^{1+} \rightarrow K + e^-$
 - $K \rightarrow K^{1+} + e^-$
- Which half-reaction correctly represents reduction?
 - $Mn^{4+} \rightarrow Mn^{3+} + e^-$
 - $Mn^{4+} \rightarrow Mn^{7+} + 3e^-$
 - ☒ $Mn^{4+} + e^- \rightarrow Mn^{3+}$
 - $Mn^{4+} + 3e^- \rightarrow Mn^{7+}$
- Which equation represents an oxidation reduction reaction?
 - ☒ $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
 - $H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$
 - $MgCrO_4 + BaCl_2 \rightarrow MgCl_2 + BaCrO_4$
 - $Zn(NO_3)_2 + Na_2CO_3 \rightarrow 2NaNO_3 + ZnCO_3$
- Given the ~~unbalanced~~ ionic equation: $Mg + Zn^{2+} \rightarrow Mg^{2+} + Zn$
 What is the total number of moles of electrons lost by Mg when 2.0 moles of electrons are gained by Zn^{2+} ?
~~When this equation is balanced, both Fe^{3+} and Fe have a coefficient of~~
 - 1.0 mol
 - 3.0 mol
 - ☒ 2.0 mol
 - 4.0 mol

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11. Given the ~~balanced~~ ^{unbalanced} equation representing a reaction:When this equation is balanced, both Mg and Mg^{2+} have a coefficient of:☒ a. 2

b. 4

c. 1

d. 8

12. During all chemical reactions, mass, energy, and charge are

a. Absorbed

b. Formed

☒ c. Conserved

d. Released

13. Which equation shows conservation of mass and charge?

☒ a. $\text{NH}_4\text{Br} \rightarrow \text{NH}_3 + \text{Br}_2$ b. $2\text{Mg} + \text{Fe}^{3+} \rightarrow \text{Mg}^{2+} + 3\text{Fe}$ ☒ c. $\text{H}_2\text{SO}_4 + \text{LiOH} \rightarrow \text{Li}_2\text{SO}_4 + \text{H}_2\text{O}$ ☒ d. $\text{Cu} + 2\text{Ag}^{1+} \rightarrow \text{Cu}^{2+} + 2\text{Ag}$

14. Which reaction occurs spontaneously?

☒ a. $3\text{Au} + \text{CrCl}_3 \rightarrow \text{Cr} + 3\text{AuCl}$ ☒ b. $2\text{Cr} + 3\text{SnCl}_2 \rightarrow 3\text{Sn} + 2\text{CrCl}_3$ ☒ c. $\text{Sn} + 2\text{RbCl} \rightarrow 2\text{Rb} + \text{SnCl}_2$ ☒ d. $\text{Cr} + 3\text{RbCl} \rightarrow 3\text{Rb} + \text{CrCl}_3$ 15. Which metal is more active than Ni and *less* active than Zn?

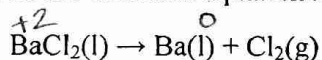
a. Cu

☒ b. Cr

c. Mg

d. Pb

16. Given the balanced equation representing a reaction occurring in an electrolytic cell:



Where is Ba(l) produced in the cell?

a. at the anode, where oxidation occurs

b. at the anode, where reduction occurs

c. at the cathode, where oxidation occurs

☒ d. at the cathode, where reduction occurs

17. Which energy conversion occurs in an electrolytic cell?

a. chemical energy to electrical energy

b. chemical energy to nuclear energy

☒ c. electrical energy to chemical energy

d. nuclear energy to electrical energy

18. An voltaic cell spontaneously converts chemical energy to

☒ a. electrical energy

b. mechanical energy

c. geothermal energy

d. nuclear energy

19. Which ~~rule~~ ^{process} occurs at the cathode in an electrochemical cell?

a. Combustion

b. Oxidation

☒ c. Neutralization☒ d. Reduction

20. A voltaic cell is constructed with the following materials:

- Nickle electrode and a Nickle Nitrate solution
- Strontium electrode and a Strontium Nitrate solution
- A salt bridge containing Potassium Chlorate
- A wire to connect the electrode

Which of the two metals will act as the anode in the working voltaic cell?

a. Nickle

☒ b. Strontium

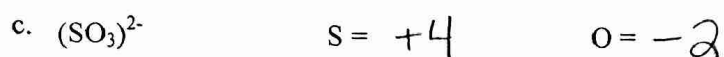
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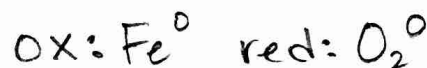
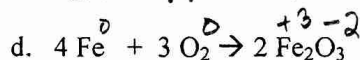
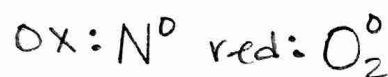
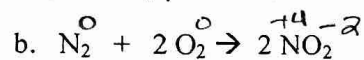
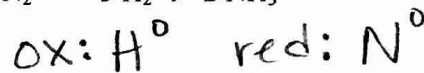
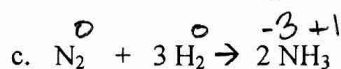
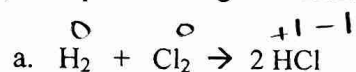
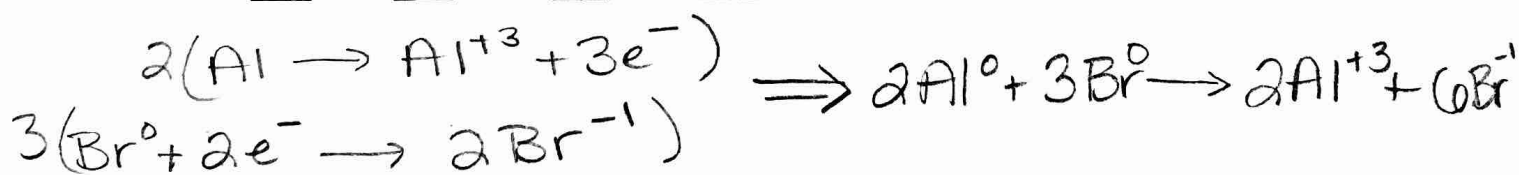
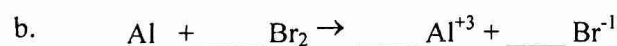
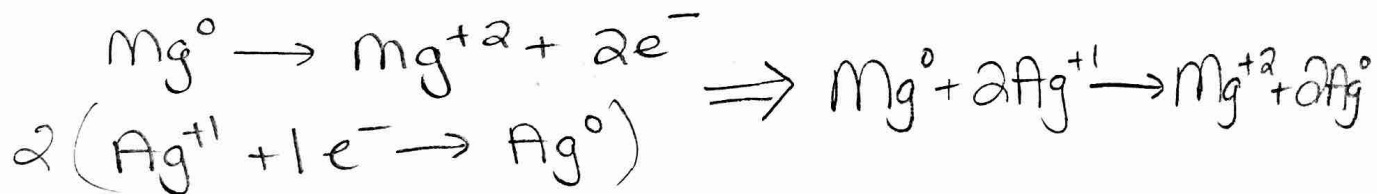
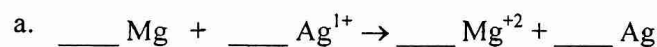
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Part B

21. What is the oxidation number of all of the atoms in the following compounds or ions?



22. Identify the species that gets oxidized and the species that gets reduced in the following reactions:

23. For each of the following reactions, write the $\frac{1}{2}$ reactions (oxidation and reduction), balance them, and combine them to write the balanced net ionic equation.

24. Which reaction will be spontaneous?

Cr with Ni^{+2} ORNi with Cr^{+2} ? (Circle one)

Explain how you know.

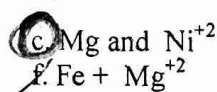
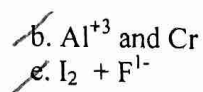
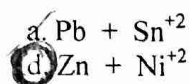
Cr is more reactive than Ni
(higher on Table J)

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25. Circle any of the following reactions that will occur spontaneously:

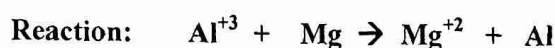


26. State the "rule" that you followed to make your decisions in question 25.

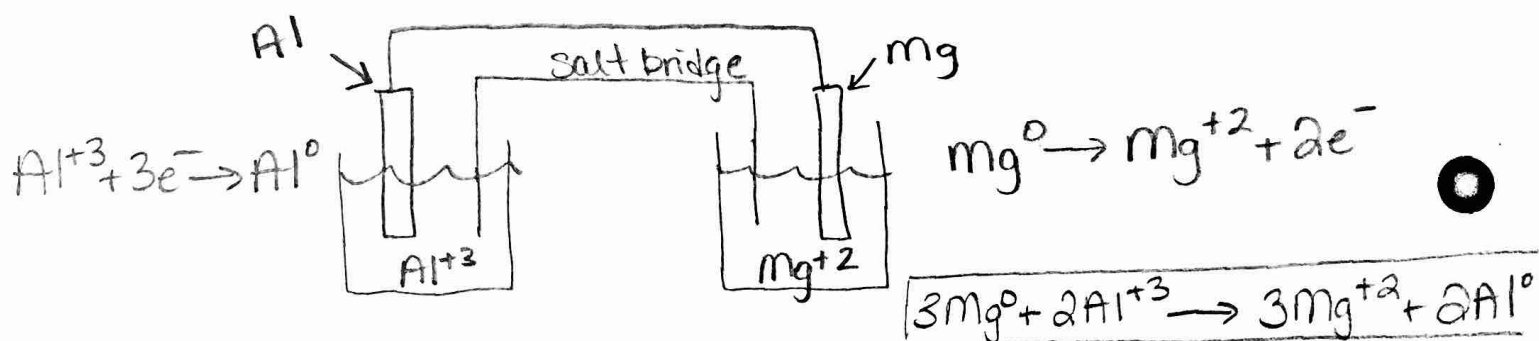
Reactions occur spontaneously if....

Solid must be higher on Table J than the ion in solution

27. Draw a voltaic cell containing Al and Mg as the metals.

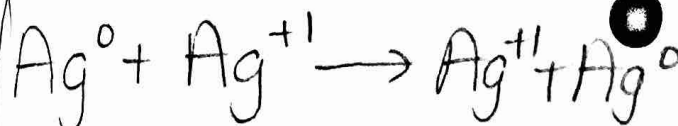
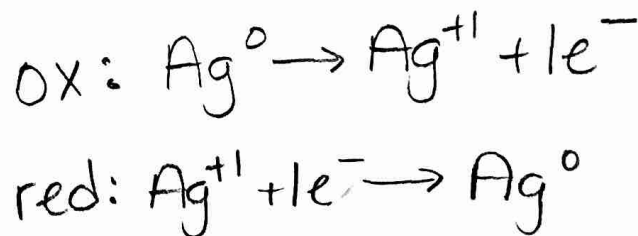
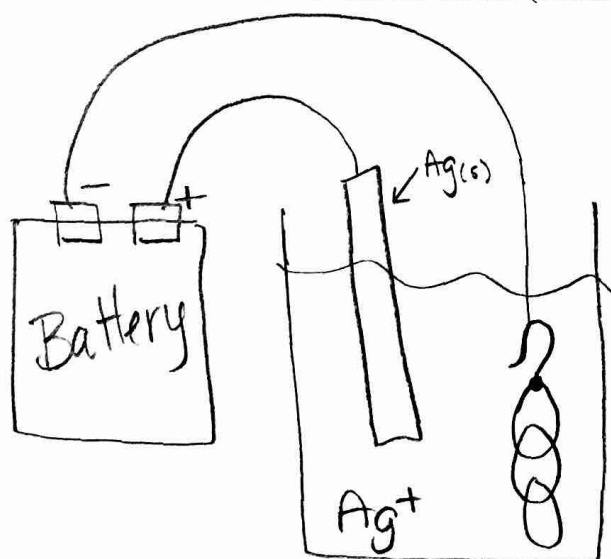


- Include and label all the necessary components of the voltaic cell.
- Write $\frac{1}{2}$ -reactions for the oxidation and the reduction.
- Write a balanced net reaction for the cell (including both oxidation and reduction).



28. Draw an electrolytic cell that could be used to plate a silver coating onto a piece of jewelry.

- Include and label all the necessary components of the electrolytic cell.
- Write $\frac{1}{2}$ -reactions for the oxidation and the reduction.
- Write a balanced net reaction for the cell (including both oxidation and reduction).



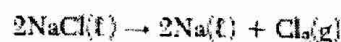
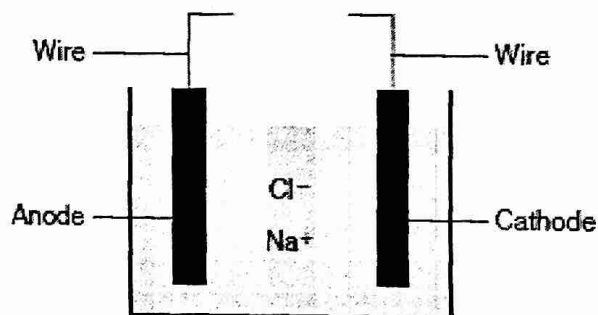
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29. Compare Voltaic and Electrolytic Cells by filling out this chart.

	Voltaic Cell	Electrolytic Cell
Difference in component parts: <i>specifically, what parts are found in this cell but not in the other?</i>	- salt bridge - 2 solutions - 2 electrodes - wire	- power source - 1 solution - 2 electrodes - wire
Cell reaction: <i>spontaneous or not?</i>	Spontaneous	NOT!
Energy conversion is: <i>Chem → Electric OR Electric → Chem</i>	chem → elec.	elec → chem
Metals: who (anode or cathode) is <i>higher and lower in Table J?</i>	Anode is more reactive → higher on J	Anode is less reactive → lower on J
Used for: <i>examples of this type of cell in real life...</i>	Batteries	electroplating

Base your answers to questions 1 through 3 on the information below.

Metallic elements are obtained from their ores by reduction. Some metals, such as zinc, lead, iron, and copper, can be obtained by heating their oxides with carbon. More active metals, such as aluminum, magnesium, and sodium, cannot be reduced by carbon. These metals can be obtained by the electrolysis of their molten (melted) ores. The diagram represents an incomplete cell for the electrolysis of molten NaCl. The equation below the diagram represents the reaction that occurs when the completed cell operates.



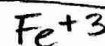
30. Identify the component required for the electrolysis of molten NaCl that is missing from the cell diagram and explain why this component is vital in order for the cell to operate.

Battery → need a power source for an electrolytic cell!

31. Identify *one* metal from the passage that is more active than carbon and *one* metal from the passage that is less active than carbon.

More active: Al/Mg/Na Less active: Zn/Pb/Fe/Cu

32. Write a balanced half-reaction equation for the reduction of the iron ions in iron(III) oxide into iron atoms.



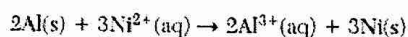
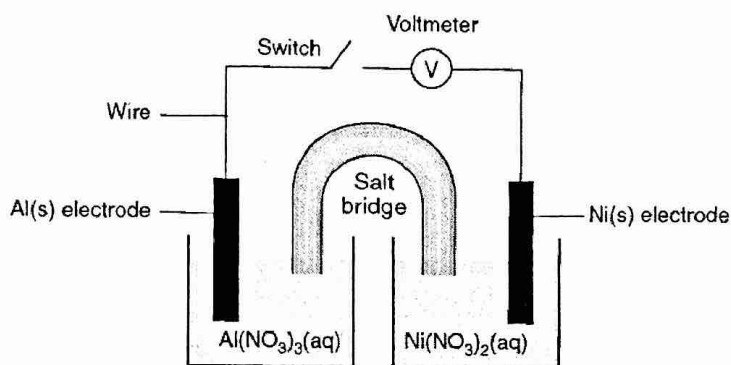
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Base your answers to questions 4 through 7 on the information below.

A student constructs an electrochemical cell during a laboratory investigation. When the switch is closed, electrons flow through the external circuit. The diagram and equation below represent this cell and the reaction that occurs.



33. State the direction of electron flow through the wire when the switch is closed.

$\text{Al} \rightarrow \text{Ni}$ / Anode to cathode

34. Write a balanced half-reaction equation for the oxidation that occurs when the switch is closed.



35. Determine the number of moles of Al(s) needed to completely react with 9.0 moles of $\text{Ni}^{2+}(\text{aq})$ ions.

$$9 \text{ moles } \text{Ni}^{2+} \cdot \frac{2 \text{ Al(s)}}{3 \text{ Ni}^{2+}} = \boxed{6.0 \text{ moles Al(s)}}$$

36. State in terms of atoms and ions why, as the cell operates, the mass of the electrodes changes. Be sure to describe how the mass changes (increase or decrease) and clearly explain why this occurs.

- As Al(s) atoms ^{are} oxidized to Al^{3+} ions in solution the mass of the Al(s) electrode decreases
- As Ni^{2+} ions are reduced to Ni(s) atoms the mass of the Ni(s) electrode increases

37. State, in terms of energy, why this cell is classified as a voltaic cell.

Voltaic because chemical energy is being converted to electrical energy.