1. Given the balanced ionic equation representing a reaction:

\[2\text{Al(s)} + 3\text{Cu}^{2+}(aq) \rightarrow 2\text{Al}^{3+}(aq) + 3\text{Cu(s)}\]

Which half-reaction represents the reduction that occurs?

A) \(\text{Al} \rightarrow \text{Al}^{3+} + 3e^-\)
B) \(\text{Al}^{3+} + 3e^- \rightarrow \text{Al}\)
C) \(\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-\)
D) \(\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}\)

2. Which half-reaction equation represents the reduction of an iron(II) ion?

A) \(\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + e^-\)
B) \(\text{Fe}^{2+} + 2e^- \rightarrow \text{Fe}\)
C) \(\text{Fe}^{3+} + e^- \rightarrow \text{Fe}^{2+}\)
D) \(\text{Fe} \rightarrow \text{Fe}^{2+} + 2e^-\)

3. Which half-reaction correctly represents reduction?

A) \(\text{Ag} \rightarrow \text{Ag}^+ + e^-\)
B) \(\text{F}_2 \rightarrow 2\text{F}^- + 2e^-\)
C) \(\text{Au}^{3+} + 3e^- \rightarrow \text{Au}\)
D) \(\text{Fe}^{2+} + e^- \rightarrow \text{Fe}^{3+}\)

4. Given the redox reaction:

\[\text{Cr}^{3+} + \text{Al} \rightarrow \text{Cr} + \text{Al}^{3+}\]

As the reaction takes place, there is a transfer of

A) electrons from Al to \text{Cr}^{3+}\)
B) electrons from \text{Cr}^{3+} to Al
C) protons from Al to \text{Cr}^{3+}\)
D) protons from \text{Cr}^{3+} to Al

5. Given the equation:

\[2\text{Al} + 3\text{Cu}^{2+} \rightarrow 2\text{Al}^{3+} + 3\text{Cu}\]

The reduction half-reaction is

A) \(\text{Al} \rightarrow \text{Al}^{3+} + 3e^-\)
B) \(\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}\)
C) \(\text{Al} + 3e^- \rightarrow \text{Al}^{3+}\)
D) \(\text{Cu}^{2+} \rightarrow \text{Cu} + 2e^-\)

6. Given the reaction:

\[\text{Mg} + \text{CuSO}_4 \rightarrow \text{MgSO}_4 + \text{Cu}\]

Which equation represents the oxidation that takes place?

A) \(\text{Mg}^{2+} + 2e^- \rightarrow \text{Mg}\)
B) \(\text{Mg} \rightarrow \text{Mg}^{2+} + 2e^-\)
C) \(\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}\)
D) \(\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-\)

7. Given the reaction:

\[2\text{Al}^0(s) + 3\text{Ni}^{2+}(aq) \rightarrow 2\text{Al}^{3+}(aq) + 3\text{Ni}^0\ (s)\]

What is the total number of moles of electrons lost by 2 moles of Al\(^0\)?

A) 6  B) 2  C) 3  D) 8

8. In the half–reaction \(\text{Pb} \rightarrow \text{Pb}^{2+} + 2e^-\), the Pb

A) is reduced  B) is oxidized
C) gains protons  D) loses protons
E) gains electrons
9. Given the reaction:

\[ \text{Zn}(s) + 2 \text{HCl}(aq) \rightarrow \text{ZnCl}_2(aq) + \text{H}_2(g) \]

Which equation represents the correct oxidation half-reaction?

A) \( \text{Zn}(s) \rightarrow \text{Zn}^{2+} + 2e^- \)
B) \( 2 \text{H} + 2e^- \rightarrow \text{H}_2(g) \)
C) \( \text{Zn}^{2+} + 2e^- \rightarrow \text{Zn}(s) \)
D) \( 2 \text{Cl}^- \rightarrow \text{Cl}_2(g) + 2e^- \)

10. Given the reaction:

\[ \text{Ca}(s) + \text{Cu}^{2+}(aq) \rightarrow \text{Ca}^{2+}(aq) + \text{Cu}(s) \]

What is the correct reduction half-reaction?

A) \( \text{Cu}^{2+}(aq) + 2e^- \rightarrow \text{Cu}(s) \)
B) \( \text{Cu}^{2+}(aq) \rightarrow \text{Cu}(s) + 2e^- \)
C) \( \text{Cu}(s) + 2e^- \rightarrow \text{Cu}^{2+}(aq) \)
D) \( \text{Cu}(s) \rightarrow \text{Cu}^{2+}(aq) + 2e^- \)

11. Base your answer to the following question on the reaction below.

\[ 2 \text{Cr}(s) + 3 \text{Cu}^{2+}(aq) \rightarrow 2 \text{Cr}^{3+}(aq) + 3 \text{Cu}(s) \]

The electronic equation that represents the oxidation reaction that occurs is

A) \( 2\text{Cr}^0 - 6e^- \rightarrow 2\text{Cr}^{3+} \)
B) \( 2\text{Cr}^0 + 6e^- \rightarrow 2\text{Cr}^{3+} \)
C) \( 2\text{Cr}^{3+} - 6e^- \rightarrow 2\text{Cr}^0 \)
D) \( 2\text{Cr}^{3+} + 6e^- \rightarrow 2\text{Cr}^0 \)

12. Which substance is most likely to gain electrons during a spontaneous redox reaction?

A) I\(_2\)  B) Li  C) Au  D) Hg  E) Ca

13. Which balanced equation represents an oxidation-reduction reaction?

A) \( \text{Ba(NO}_3\text{)}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaNO}_3 \)
B) \( \text{H}_3\text{PO}_4 + 3\text{KOH} \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O} \)
C) \( 2\text{Fe}(s) + \text{S}(s) \rightarrow \text{FeS} \)
D) \( \text{NH}_3(g) + \text{HCl}(g) \rightarrow \text{NH}_4\text{Cl}(s) \)

14. Which balanced equation represents a redox reaction?

A) \( \text{AgNO}_3(aq) + \text{NaCl}(aq) \rightarrow \text{AgCl}(s) + \text{NaNO}_3(aq) \)
B) \( \text{H}_2\text{CO}_3(aq) \rightarrow \text{H}_2\text{O}(\ell) + \text{CO}_2(g) \)
C) \( \text{NaOH}(aq) + \text{HCl}(aq) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(\ell) \)
D) \( \text{Mg}(s) + 2\text{HCl}(aq) \rightarrow \text{MgCl}_2(aq) + \text{H}_2(g) \)

15. In which reaction are electrons transferred from one reactant to another reactant?

A) \( 2\text{Ca}(s) + \text{O}_2(g) \rightarrow 2\text{CaO}(s) \)
B) \( \text{AgNO}_3(aq) + \text{KCl}(aq) \rightarrow \text{AgCl}(s) + \text{KNO}_3(aq) \)
C) \( \text{HCl}(aq) + \text{NaOH}(aq) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(\ell) \)
D) \( \text{H}_3\text{O}^+(aq) + \text{OH}^-(aq) \rightarrow 2\text{H}_2\text{O}(\ell) \)

16. Which change in oxidation number represents oxidation?

A) \( \text{Sn}^{2+}(aq) \rightarrow \text{Sn}^{4+}(aq) \)
B) \( \text{Sn}^{2+}(aq) \rightarrow \text{Sn}(s) \)
C) \( \text{Sn}^{4+}(aq) \rightarrow \text{Sn}^{2+}(aq) \)
D) \( \text{Sn}^{4+}(aq) \rightarrow \text{Sn}(s) \)
E) \( \text{Sn}(s) \rightarrow \text{Sn}^{2-}(aq) \)
17. Base your answer to the following question on the information below.

Litharge, PbO, is an ore that can be roasted (heated) in the presence of carbon monoxide, CO, to produce elemental lead. The reaction that takes place during this roasting process is represented by the balanced equation below.

\[ \text{PbO(s)} + \text{CO(g)} \rightarrow \text{Pb(\ell)} + \text{CO}_2(\text{g}) \]

Determine the oxidation number of carbon in carbon monoxide.

A) increases by 2  
B) increases by 4  
C) increases by 6  
D) increases by 8  
E) does not change

18. When NO\(_2\) reacts to form N\(_2\)O\(_4\), the oxidation number of nitrogen

A) increases by 2  
B) increases by 4  
C) increases by 6  
D) increases by 8  
E) does not change

19. \( \text{PbO}_2 + \text{Pb} + 4 \text{H}^+ + 2 \text{SO}_4^{2-} \rightarrow 2 \text{PbSO}_4 + 2 \text{H}_2\text{O} \)

Which substance loses electrons in the redox reaction above?

A) Pb  
B) PbO\(_2\)  
C) \( \text{H}^+ \)  
D) \( \text{SO}_4^{2-} \)  
E) PbSO\(_4\)
In a laboratory investigation, magnesium reacts with hydrochloric acid to produce hydrogen gas and magnesium chloride. This reaction is represented by the unbalanced equation below.

\[
\text{Mg(s) + HCl(aq) \rightarrow H}_2\text{(g) + MgCl}_2\text{(aq)}
\]

Write a balanced half-reaction equation for the oxidation that occurs.
1. D
2. B
3. C
4. A
5. B
6. B
7. A
8. B
9. A
10. A
11. A
12. A
13. C
14. D
15. A
16. A
17. +2.
18. E
19. A
20. Mg → Mg^{2+} + 2e^{-}