Redox Concept Inventory

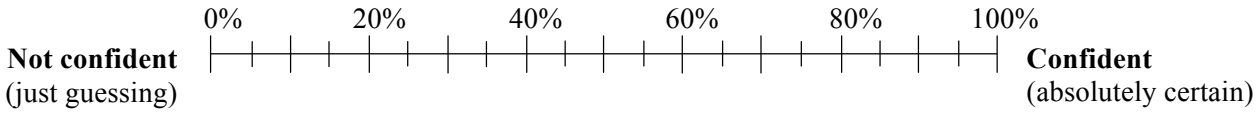
DIRECTIONS: Please choose the **one best** answer for each question. There are 18 questions in total. At the end of each question, place an 'x' anywhere on the confidence scale to rate how confident you feel about your response.

1. Is this an oxidation-reduction reaction?

$$Zn(s) + Cu(NO_3)_2(aq) \rightarrow Zn(NO_3)_2(aq) + Cu(s)$$

A. Yes
B. No

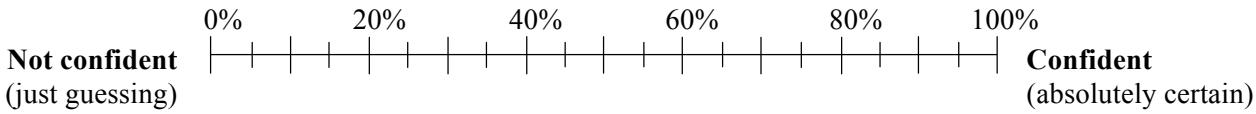
How confident are you about your response? (place an 'x' anywhere on the line)



2. I chose my answer to question 1 because…

A. the charges on zinc, copper, and nitrate do not change.
B. the reactants are an aqueous solution and a metal.
C. the zinc and copper exchange places.
D. the charge on zinc increases, while the charge on copper decreases.

How confident are you about your response?



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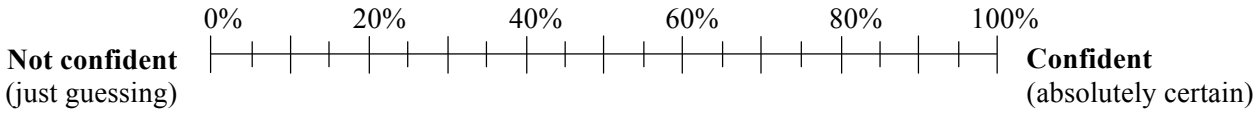
3. Is this an oxidation-reduction reaction?

$$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$$

A. Yes
B. No

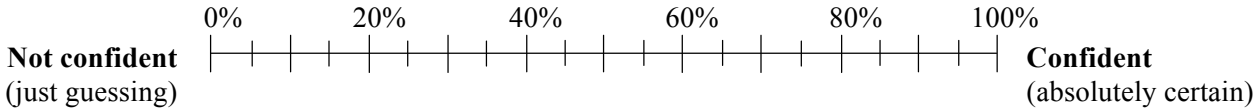
How confident are you about your response?



4. I chose my answer to question 3 because…

A. it is a combination reaction.
B. $O_2(g)$ gives electrons to $Al(s)$ to form a bond.
C. the charge on $Al(s)$ changes, and the charge on $O_2(g)$ also changes.
D. there is only one product, so oxidation and reduction cannot both occur.

How confident are you about your response?



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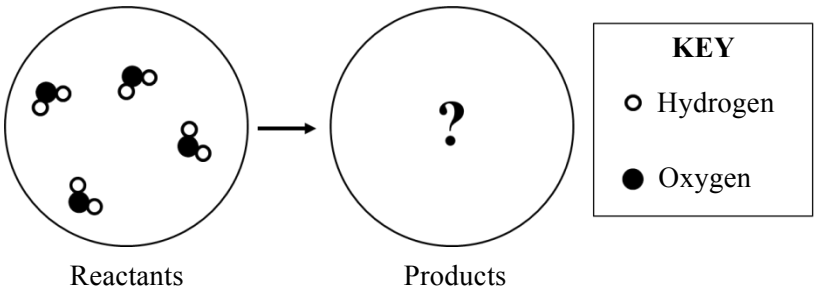
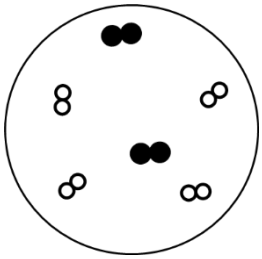
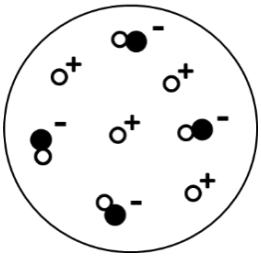
5. Which image would ***best*** represent the products if the reactants below underwent an oxidation-reduction reaction?



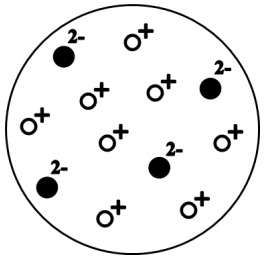
A.



B.

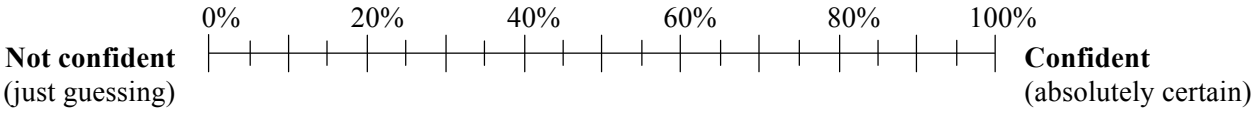


C.



D. Oxidation-reduction cannot occur under any conditions.

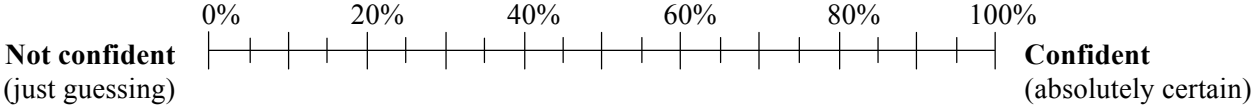
How confident are you about your response?



6. I chose my answer to question 5 because…

A. oxidation and reduction cannot occur with uncharged reactants.
B. oxidation and reduction cannot occur when there is only one reactant.
C. the oxidation numbers change from 0 to -2 for oxygen and from 0 to +1 for hydrogen.
D. the oxidation numbers change from -2 to 0 for oxygen and from +1 to 0 for hydrogen.

How confident are you about your response?



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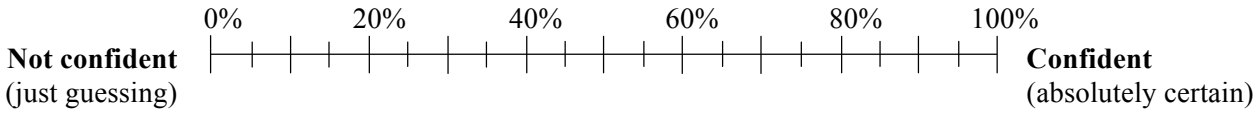
7. Below is an oxidation-reduction reaction in which Cu(*s*) loses electrons. Which statement is also ***true***?

$$Cu(s) + 4H^+(aq) + 2NO_3^-(aq) \rightarrow Cu^{2+}(aq) + 2NO_2(g) + 2H_2O(l)$$

A. H^+ is reduced.
B. N is reduced.
C. NO_3^- is oxidized and N is reduced.
D. NO_3^- is oxidized and H^+ is reduced.

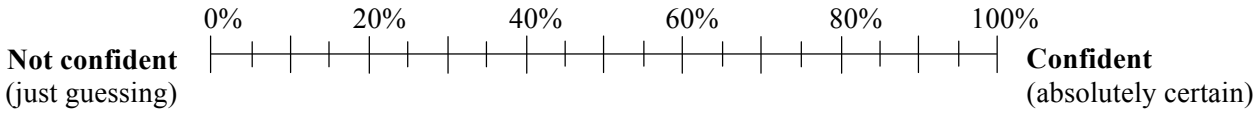
How confident are you about your response?



8. Which statement about oxidation numbers and charges is ***true***?

A. Both charges and oxidation numbers can be determined from the phase of a substance [e.g. Cu(*s*)].
B. A charge is assigned to an entire compound, while an oxidation number is assigned to an individual element.
C. A charge exists, but an oxidation number is theoretical.
D. A charge represents the number of valence electrons, but an oxidation number represents the number of bonding electrons.

How confident are you about your response?



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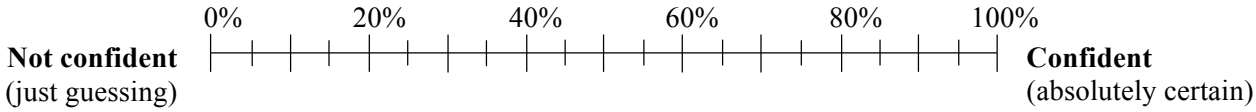
DIRECTIONS: Below is an oxidation-reduction reaction. Use this reaction to answer questions 9, 10, and 11.

$$Fe(s) + CdSO_4(aq) \rightarrow FeSO_4(aq) + Cd(s)$$

9. In the above reaction, electrons transfer…

   A. from cadmium to iron.
   B. from iron to cadmium.
   C. from cadmium to sulfate and from sulfate to iron.
   D. from iron to sulfate and from sulfate to cadmium.

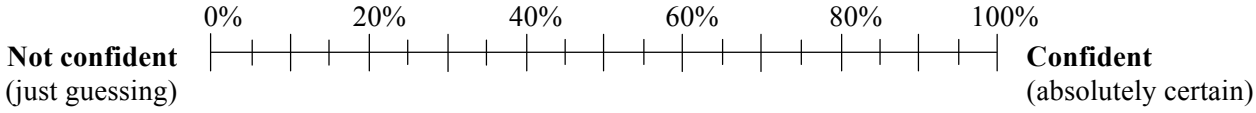
   How confident are you about your response?



10. How do the electrons transfer in this reaction?

   A. The bond between cadmium and sulfate breaks, and the iron bonds with sulfate.
   B. The electrons travel freely through solution.
   C. The sulfate carries the electrons from one metal to another.
   D. Cadmium deposit onto the solid iron atoms.

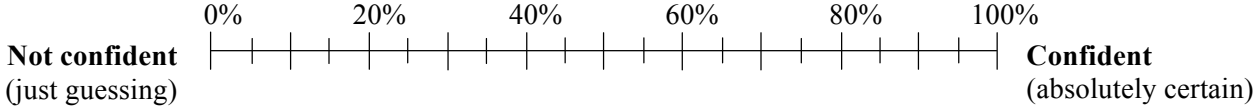
   How confident are you about your response?



11. Which statement is ***true*** about the cadmium, iron, and sulfate in this reaction?

   A. The aqueous cadmium and iron are charged because sulfate exists.
   B. Sulfate balances the charges of cadmium and iron in solution.
   C. Sulfate bonds with cadmium and with iron.
   D. Sulfate reacts with cadmium and with iron.

   How confident are you about your response?



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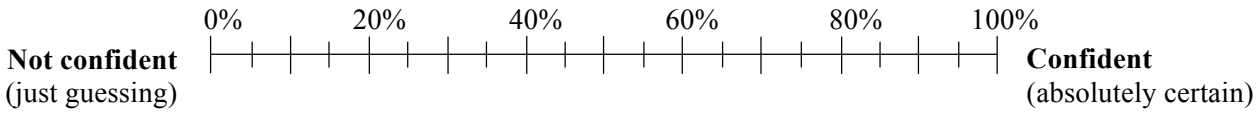
12. Which statement(s) is/are ***true*** about oxidation-reduction reactions?

I. Oxidation can happen without reduction.
II. A metal must be a reactant.

A. I only
B. II only
C. Both I and II
D. Neither I nor II

How confident are you about your response?

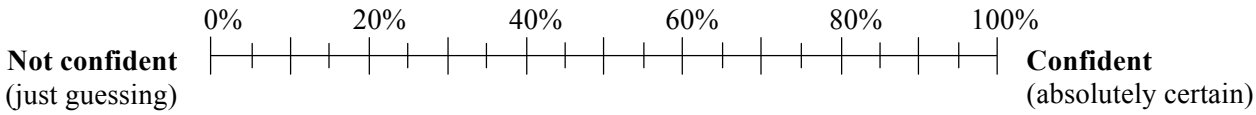


13. Which statements are ***true*** for $CuSO_4(aq)$?

I. Sulfur has an oxidation number, but no charge.
II. Sulfur has both an oxidation number and a charge.
III. Sulfate has a charge, but no oxidation number.
IV. Sulfate has both a charge and an oxidation number.

A. I and III
B. I and IV
C. II and III
D. II and IV

How confident are you about your response?



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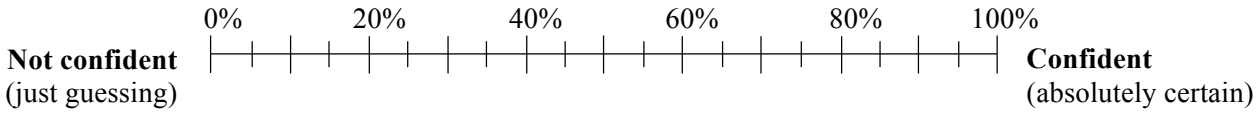
14. Which statement is ***true*** about the following reaction?

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

A. The oxidation number of C changes from -4 to +4.
B. The oxidation number of C remains +4 throughout the reaction.
C. All the reactants and products have an oxidation number of 0 because they are gases.
D. This is a combustion reaction, not an oxidation-reduction reaction.

How confident are you about your response?

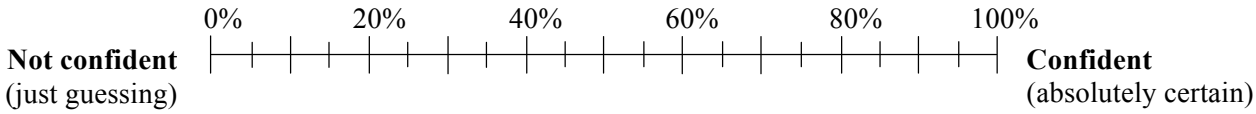


15. The oxidation number for hydrogen in the reaction below…

$$Fe(s) + 2HCl(aq) \rightarrow FeCl_2(aq) + H_2(g)$$

A. changes from +1 to +2.
B. changes from +2 to 0.
C. changes from +1 to 0.
D. remains at +2 throughout the reaction.

How confident are you about your response?



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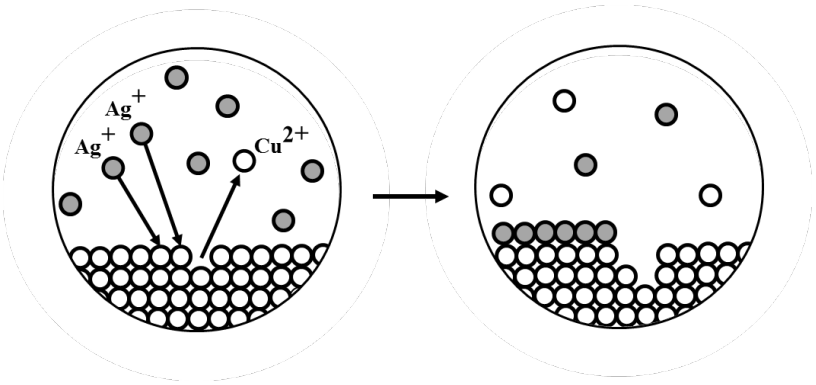
DIRECTIONS: The images below show a cross-sectional view for the oxidation-reduction reaction of Cu(*s*) with $AgNO_3(aq)$. Nitrate is ***not shown*** in the images. Use the images to answer questions 16, 17, and 18.



16. Which statement ***best*** describes ***silver*** in this reaction?

A. Two Ag^+ push Cu^{2+} off the solid and into the solution.
B. Two Ag^+ replace the charge that is missing on the solid when Cu^{2+} leaves.
C. Two Ag^+ are attracted to the electrons that are left on the solid when Cu^{2+} leaves.
D. Two Ag^+ receive electrons from the Cu solid.

How confident are you about your response?

0% 20% 40% 60% 80% 100%

Not confident (just guessing) — **Confident** (absolutely certain)

17. Which statement ***best*** describes ***copper*** in this reaction?

A. Cu^{2+} must leave to create a space for Ag^+ to deposit.
B. As Cu becomes an ion, it leaves the solid.
C. Cu^{2+} has a greater charge than the Ag^+, so Cu^{2+} is attracted into the solution by NO_3^-.
D. When Cu^{2+} leaves the solid, two electrons remain behind.

How confident are you about your response?

0% 20% 40% 60% 80% 100%

Not confident (just guessing) — **Confident** (absolutely certain)

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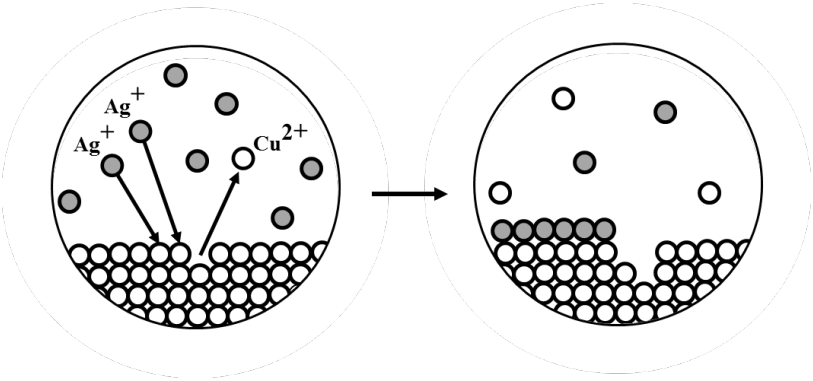
DIRECTIONS: ***Continued from previous page…***

The images below show a cross-sectional view for the oxidation-reduction reaction of Cu(*s*) with $AgNO_3(aq)$. Nitrate is ***not shown*** in the images. Use the images to answer questions 16, 17, and 18.



18. Which statement ***best*** describes ***nitrate*** in this reaction?

A. NO_3^- receives the electrons from one metal and passes them to the other.
B. The negative charge on NO_3^- attracts the metal into the solution.
C. NO_3^- is not involved in the electron transfer.
D. NO_3^- is irrelevant for the reaction because it cancels out in the net ionic equation.

How confident are you about your response?

0% 20% 40% 60% 80% 100%

Not confident (just guessing) — **Confident** (absolutely certain)

Thank you for completing the Redox Concept Inventory!

Please check to make sure you have…

1. **one response for each of the 18 questions.**
2. **a confidence rating for each of the 18 questions.**