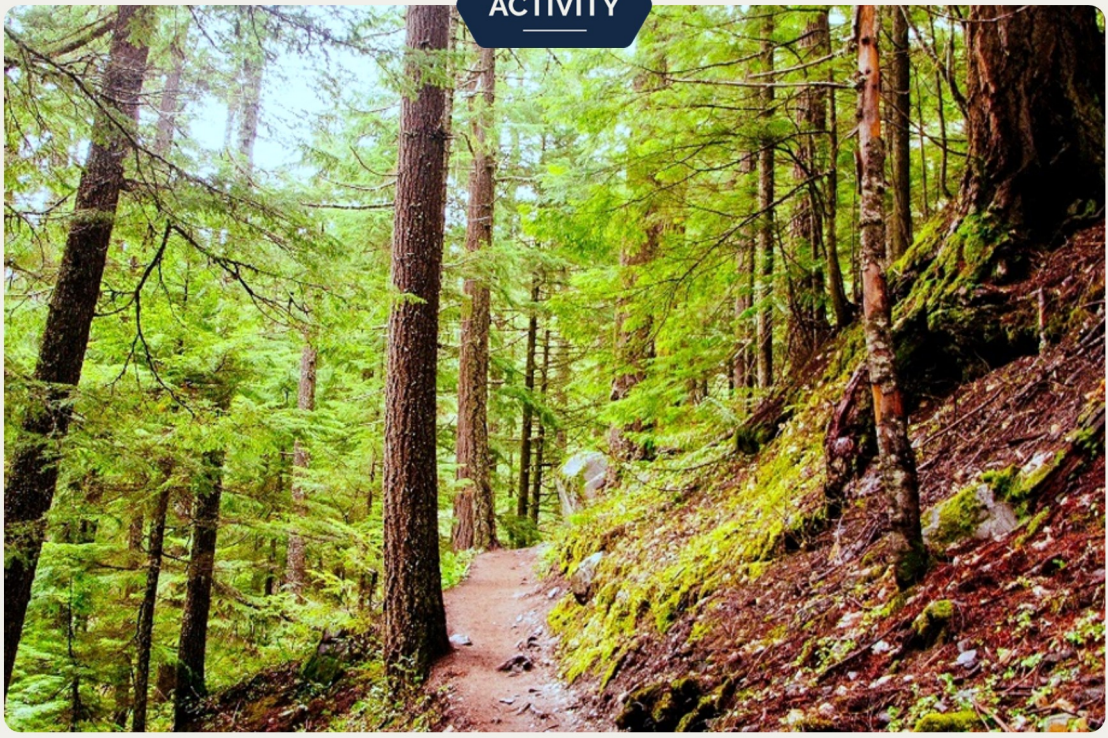
Redox & Electrochemistry

Question Trails – Print, Digital, & Editable

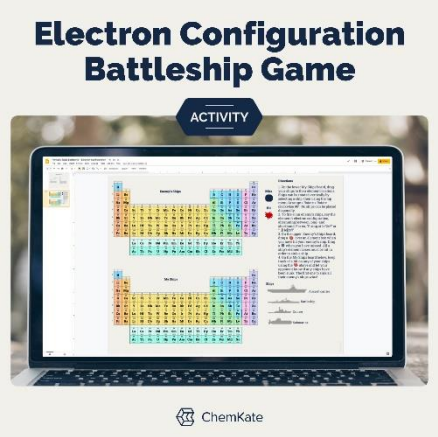
ACTIVITY

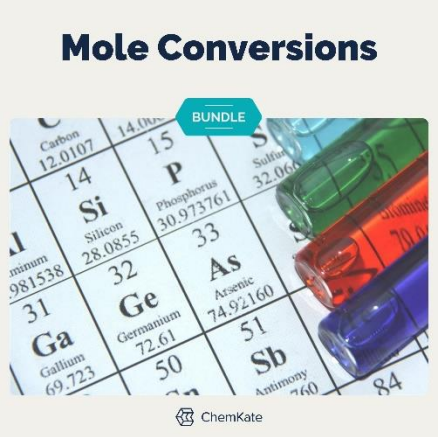


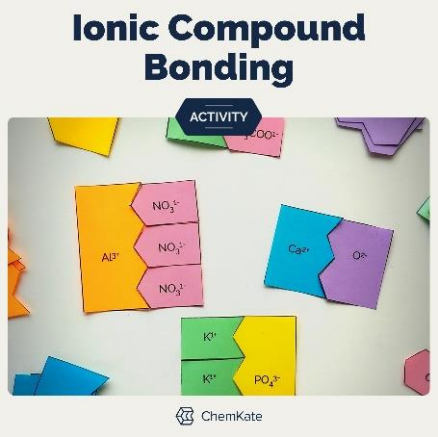
ChemKate

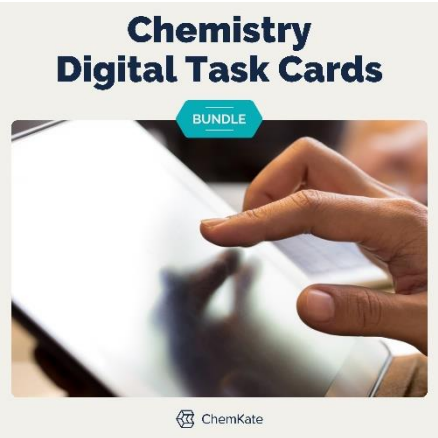
Redox and Electrochemistry Question Trails

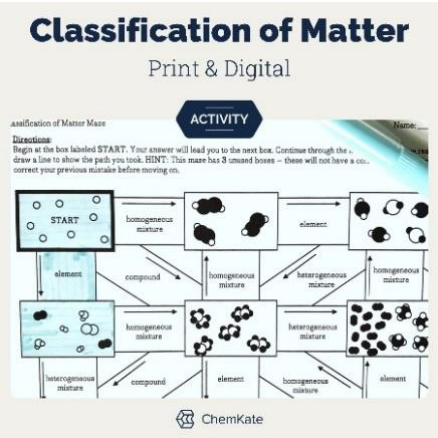
Thank you for your download! You might also be interested in the linked images below:

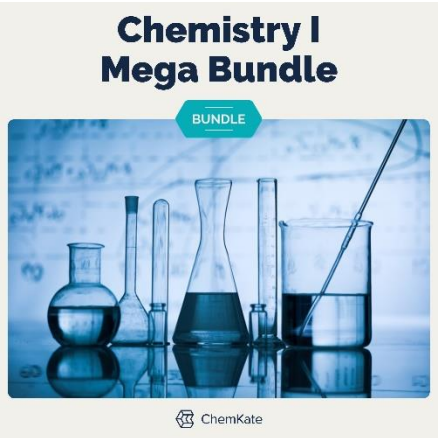












These two *no-prep, self-monitoring, print, and digital* activities provide practice with oxidation numbers, half-reactions, and galvanic cells in an *engaging* way. This "choose your own adventure" activity gives you time to help those who need it as students *self-monitor* their work. Additional Google slide decks allow you to edit both the printable and digital question trails.

✦ This is available in my *costs-savings* Redox Reactions Bundle, Chemistry Question Trails Bundle, and *save time and assurance* with all the activities found in this Chemistry I MEGA Activity Bundle - Visit this to see a wide variety of many *no-prep, print and digital inquiry activities, graphic organizers and application* ✦

Printable Version Tips:

1. Print out the slides and tape them around your room in order. Start on one side of your room and circle around the walls so that it is easy for a student to locate the question they are to go to next. Printing them on colored paper is not required but will make them easier to locate. Students may work in small groups or individually to complete these.

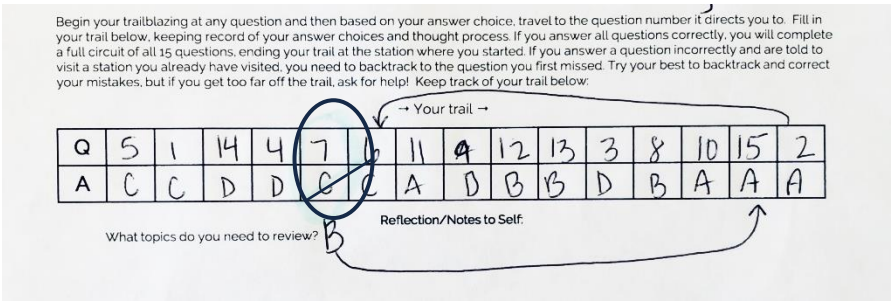
2. Students can begin anywhere on their trail. Their answer choice will direct them to a new question. If they make a full circuit through all the questions, and end at the question where they began, they will have gotten them all correct. Students may ask you to check their work after they have visited all questions, however, if they were directed back to their first question, then they got them all correct. There is only one trail for this to happen and they will have completed them successfully. This will provide you the time to help those who need it.

Redox and Electrochemistry Question Trails cont.

3. If students repeat any question, it means they have made a mistake. They will need to backtrack to find their mistake. If they have troubles finding their way back onto the trail, then they are directed to ask you to help get them back onto the correct trail once again. I keep a printout of the key in my hand for a quick comparison of trails.

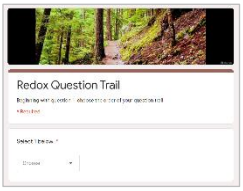
4. As students move around the room, they keep record of their trail [question order], their answer choice, and their work/notes to self on their provided student half-sheet.

A time-saving tip for students who get off track:
Sometimes students get off trail and can't figure out which one they missed. They will come to you to help them figure out which problem they missed, and you can send them back to make their correction. Once they correct it (or ask for further help), they will either continue a new trail or pick up where they have already visited. To save time, *they do not need to erase their previous correct trail,* they can continue their trail in the remaining boxes. If they draw arrows, that helps identify their trail, as seen in the generic example below:



In this example, a student missed number 7, but didn't catch the mistake until they got to #15. Once corrected, this leads them back onto their trail. Students can do this with any mistake they make so that they visit all the questions.

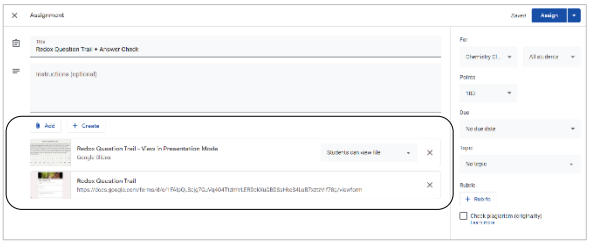
Accessing the Digital Activities
1. Be sure you are logged into the Google account you want to save your files into first. When you select the links below, it will ask you to make a copy of the assignment. Select "Make a Copy".

Preview	Digital File(s)	
	Redox Digital Question Trail	Electrochemistry Digital Question Trail
	Redox Answer Check Electrochemistry Answer Check Posting this ViewForm link allows your students to check and correct their trail on their own. It will give them corrective feedback, but you won't have access to their submissions. I prefer to run my digital question trails formatively this way, but if you would like to see their data, see the next column.	Redox Answer Check – Data Electrochemistry Answer Check - Data Answers are built in and you will have access to student entries. This is currently set to allow students to view their accuracy after submitting and submit another response. The last portion encourages them to fix their own mistakes. For more help with how to edit google forms, select the Google link here.

Redox and Electrochemistry Question Trails cont.

2. These copies in your drive are now your Master Templates, except for the practice check which is ViewForm. I recommend changing the name of the files and organizing them into a folder to easily access it later.

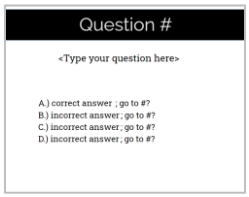
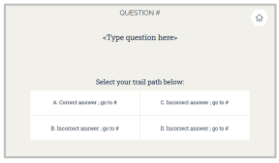
Sharing with Students on Google Classroom™
After creating an assignment on Classroom, locate the files in your Google drive. For the Google slide deck, select either "View file" or "Make a Copy for Each Student" so that students won't be able to change your original file. I also attach the answer check ViewForm link on the assignment too.



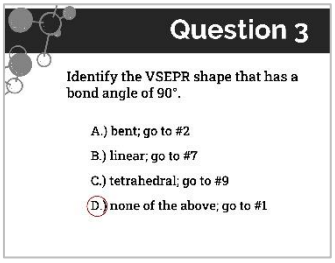
Editing:
When you replace a question with a new question, be sure that:

- the *same* correct answer choice is used.
- the trail *number order* is the same.

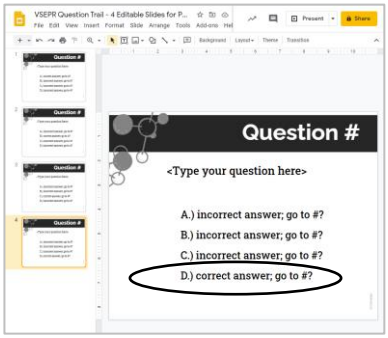
More details below:

Preview	Digital File(s)
	Redox Question Trail – 4 Editable Slides for Printable PDFs Electrochemistry Question Trail – 4 Editable Slides for Printable PDFs The link above is to a Google slide deck. If you prefer to work in PowerPoint, once copied and opened, you can download it to PowerPoint by selecting File > Download > Microsoft PowerPoint (.pptx).
	Redox Question Trail – 4 Editable Slides for Digital Trail Electrochemistry Question Trail – 4 Editable Slides for Digital Trail (These two decks are identical)

How to Edit Printable PDF Version:
The following example is set to a VSEPR question trail but works the same way for this question trail. If you don't teach bond angles and want to replace this question:

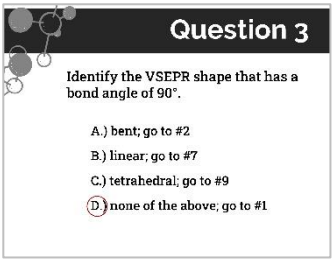


You will want to replace it with the 4th Google Slide question from the link above. The 4th Google Slide question from the slide deck has letter D as the correct answer, which matches the replaceable PDF Question #3.

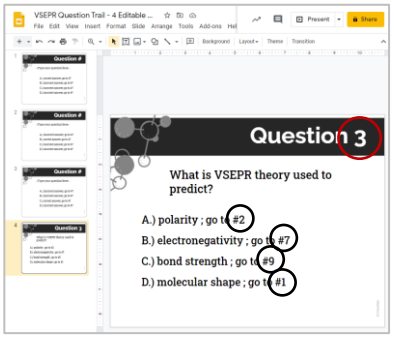


Redox and Electrochemistry Question Trails cont.

Edit the Google slide deck question by replacing the question number, the question, the incorrect/correct answer choices and make the "go to #" the same choices as the replaceable Question #3. See example below:

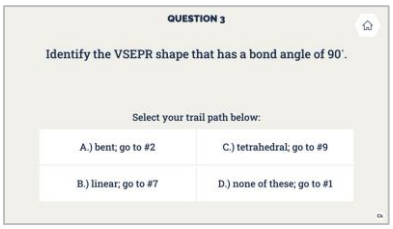


could be replaced with this question:

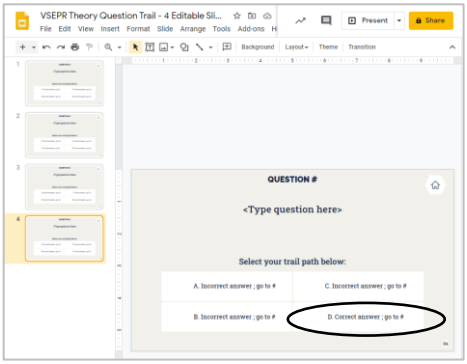


Notice that not only did I replace the question and the answer choices, keeping letter D as the correct answer, but the red circled changes use *the same "go to #" order as before*. This question can now be printed and used to replace the original bond angle PDF Question #3.

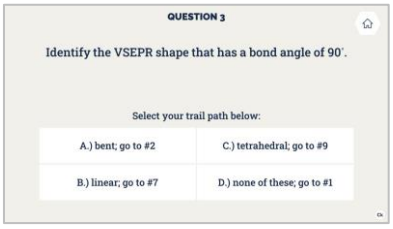
How to Edit the Digital Version:
The following example is set to a VSEPR question trail but works the same way for this question trail. If you don't teach bond angles and want to replace this question:



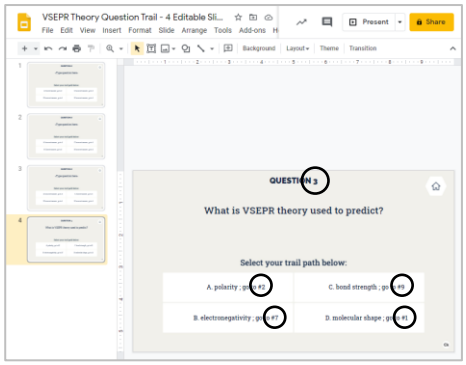
Similar to editing the PDF version, you want to replace it with the 4th question slide from the link on the previous page. The 4th question from the slide deck has letter D as your correct answer, which matches the replaceable Question #3.



Edit the slide deck question to a new question, replacing the question number, the question, the incorrect/correct answer choices and make the "go to #" the same choices as the replaceable Question #3. See example below:



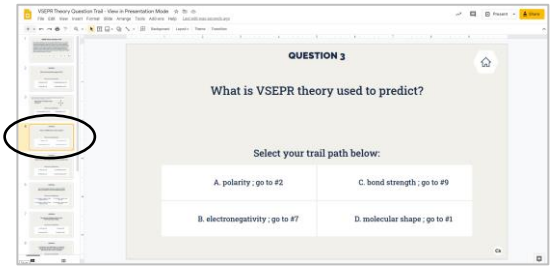
could be replaced with this question:



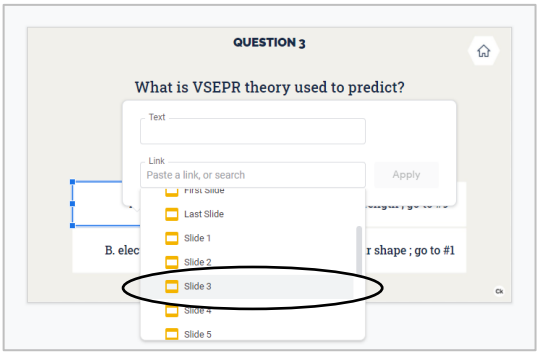
Redox and Electrochemistry Question Trails cont.

Notice that not only did I replace the question and the answer choices, keeping letter D as the correct answer, but the red circled changes use *the same "go to #" order as before* were also made.

Next, copy and paste this new slide into your digital question trail replacing the original question #3. If Google prompts you to link the two slide decks, select "do not link".

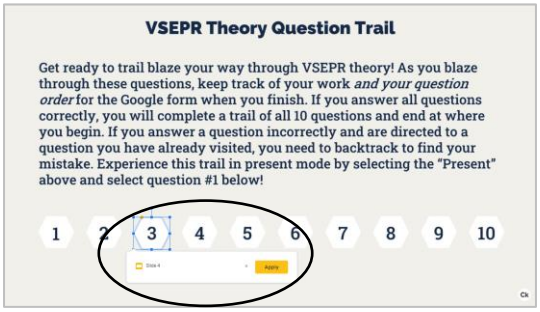


Next, you will need to hyperlink the answer choices to their corresponding slide in the trail. To do so, select an answer choice and right-click. Then select "Link". This will open a field for you to select "Slides in this presentation". After selecting this, scroll down to the slide you want it to go to. For this slide deck, because the first slide is for directions, you will want to *choose the slide that is one number higher than the "go to #"*. For example, answer choice A tells a student to "go to #2". You will want to link this answer choice to *slide #3*. Select "Apply" after the correct slide # has been chosen.



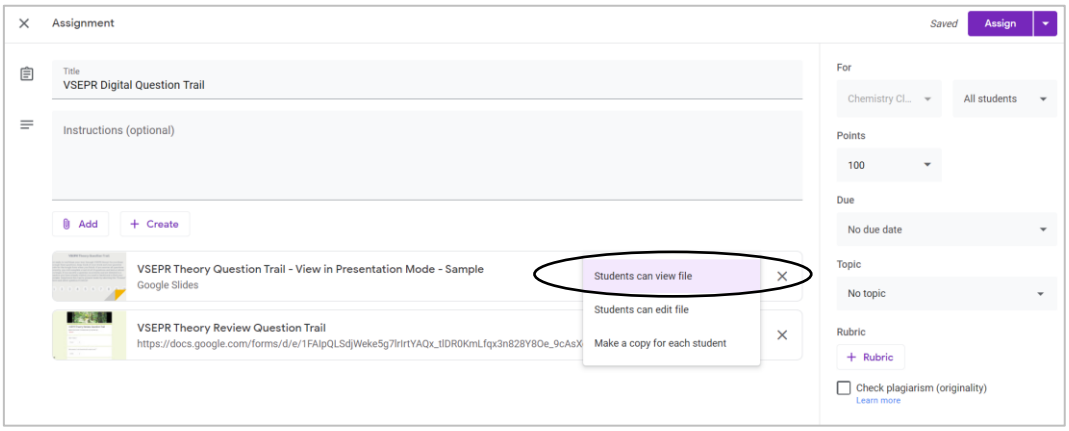
Repeat this for each of the answer choices. I would also recommend you check the slide links by presenting the slide deck and selecting your new links.

Next, you will need to relink the first slide to the new slide you just added. Select the hexagon question and right-click. Then select "Link". This will open a field for you to select "Slides in this presentation". After selecting this, scroll down to the slide you want it to go to. For this slide deck, because the first slide is for directions, you will want to *choose the slide that is one number higher than the question slide*. For example, hexagon 3 needs to link to question 3, but will need to be linked to *slide 4*. Select " Apply" after the correct slide has been chosen.



Redox and Electrochemistry Question Trails cont.

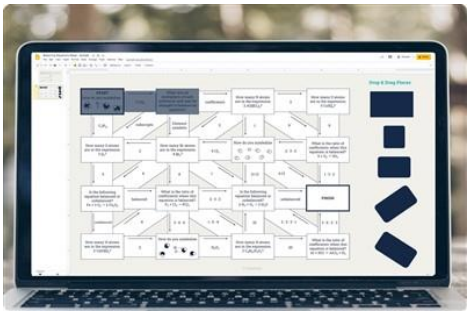
Sharing with Students on Google Classroom
Like how you would have shared an unedited digital question trail, you will want to assign this to new digital slide deck to your students, except this time you would want to select "Students can *view* file" since you don't want them to have editing right to the new question.



If you need any assistance, contact me at KateCk@ChemKate.com .

Receive this Freebie!

Get this exclusive *no-prep* balancing equation maze - *in print and digital* formats that are *self-checking and easy to grade*, as well as receiving tips, ideas, and resources periodically sent to you.



Send My Maze!

Interested in more great resources? Click on the linked icons below:

Bd Bonding | Nm Naming | Ml Mole | Vs VSEPR | Lb Labs

Thank you for your purchase!
Did you know that you can receive credit towards future TpT purchases by reviewing this product? I love hearing how things worked for you and I appreciate your support by leaving your review for this product by scrolling down to the bottom of the link below:

Get My TpT Credit

I enjoy making supportive classroom resources for you, so if you have questions or suggestions, contact me at **KateCk@ChemKate.com**.

Let's connect!

TpT Instagram Pinterest

Credits:
All graphics by © ChemKate

Thank you!

Redox Question Trail Name: _____ Pd:____

Begin your trailblazing at any question and then based on your answer choice, travel to the question number it directs you to. Fill in your trail below, keeping record of your answer choices and thought process. If you answer all questions correctly, you will complete a full circuit of all the questions, ending your trail at the station where you started. If you answer a question incorrectly and are told to visit a station you already have visited, you need to backtrack to the question you first missed. Try your best to backtrack and correct your mistakes, but if you get too far off the trail, ask for help! Keep track of your trail below:

Q																			
A																			

Workspace:
Record your station number & show your work below.

Reflection: Circle the number of how you feel after this question trail.

4	I can do it without mistakes. I can help others.	Explain.
3	I can do it by myself. I make little mistakes.	
2	Sometimes I need help and have some questions.	
1	I can't do it by myself. I don't understand yet.	

Redox Question Trail Name: _____ Pd:____

Begin your trailblazing at any question and then based on your answer choice, travel to the question number it directs you to. Fill in your trail below, keeping record of your answer choices and thought process. If you answer all questions correctly, you will complete a full circuit of all the questions, ending your trail at the station where you started. If you answer a question incorrectly and are told to visit a station you already have visited, you need to backtrack to the question you first missed. Try your best to backtrack and correct your mistakes, but if you get too far off the trail, ask for help! Keep track of your trail below:

Q																			
A																			

Workspace:
Record your station number & show your work below.

Reflection: Circle the number of how you feel after this question trail.

4	I can do it without mistakes. I can help others.	Explain.
3	I can do it by myself. I make little mistakes.	
2	Sometimes I need help and have some questions.	
1	I can't do it by myself. I don't understand yet.	

Question 1

Identify the oxidation number of $\underline{Cl_2}$.

A. 0 ; go to #14
B. +2 ; go to #7
C. -1 ; go to #15
D. -2 ; go to #11

Question 2

What does the following half-reaction show?

$$Zn(s) \rightarrow Zn^{2+}(aq) + 2\ e^-$$

A. gain of electrons ; go to #4
B. donation of a proton ; go to #20
C. oxidation ; go to #6
D. reduction ; go to #13

Question 3

Identify the oxidation number of Fe in $\underline{Fe}Cl_2$.

A. +1 ; go to #9

B. -2 ; go to #17

C. +2 ; go to #10

D. -1 ; go to #5

Question 4

Identify what is **reduced** in the reaction below:

$P_4 + 6\ Br_2 \rightarrow 4\ PBr_3$

A. P^{3+} ; go to #10
B. P ; go to #3
C. Br_2 ; go to #20
D. Br^- ; go to #17

Question 5

Identify the oxidation number of Cl in $\underline{Cl}O_2^{1-}$.

A. +3 ; go to #12

B. +4 ; go to #16

C. -1 ; go to #19

D. +1 ; go to #1

Question 6

Identify the oxidation number of Na.

A. 0 ; go to #13
B. -1 ; go to #4
C. +1 ; go to #20
D. +2 ; go to #3

Question 7

What has happened to a substance if its oxidation state changed from +4 to +7?

A. It has gained 3 electrons ; go to #11
B. It has gained 2 protons ; go to #8
C. It was reduced ; go to #18
D. It has lost 3 electrons ; go to #15

Question 8

Identify what is **oxidized** in the reaction below:

$2\ HCl(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + CaCl_2(aq)$

A. O^{2-} ; go to #2
B. Cl^- ; go to #6
C. H^+ ; go to #13
D. Nothing, it is not a redox reaction; go to #18

Question 9

Identify the oxidation number of N in $Mg(\underline{N}O_3)_2$.

A. +5 ; go to #5

B. +3 ; go to #12

C. -3 ; go to #16

D. -2 ; go to #19

Question 10

True or False: A substance that is oxidized has lost electrons.

A. True ; go to #17
B. False ; go to #9

Question 11

To balance the following half-reaction, how many electrons and on which side should they be added?

$Li^+(aq) \rightarrow Li(s)$

A. 2 electrons on the product side ; go to #18
B. 1 electron on the reactant side ; go to #8
C. 2 electrons on the reactant side ; go to #2
D. 1 electron on the product side ; go to #6

Question 12

Identify what is **oxidized** in the reaction below:

$Fe(s) + Cu(NO_3)_2(aq) \rightarrow 2\ Cu(s) + Fe(NO_3)_2(aq)$

A. $Cu^{2+}(aq)$; go to #19
B. $Fe(s)$; go to #16
C. $N^{5+}(aq)$; go to #1
D. $Cu(s)$; go to #14

Question 13

To balance the following half-reaction, how many electrons and on which side should they be added?

$O_2(g) \rightarrow 2\ O^{2-}(aq)$

A. 2 electrons on the product side ; go to #20
B. 4 electrons on the reactant side ; go to #4
C. 2 electrons on the reactant side ; go to #3
D. 4 electrons on the product side ; go to #10

Question 14

Assign oxidation numbers to each element in the following redox reaction:

$Mg(s) + 2\ HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

A. 0; +1,-1; +2,-1; 0 ; go to #7

B. +2; +1,-1; +2,-1; 0 ; go to #15

C. +2; +1,-1; +2,-1; +1 ; go to #11

D. 0; +1,-1; +2,-1; +1 ; go to #8

Question 15

Identify the oxidation number of Pb in $\underline{Pb}S_2$.

A. -4 ; go to #2
B. +4 ; go to #11
C. -3 ; go to #8
D. +3 ; go to #18

Question 16

What process is shown in the half-reaction below?

$S^{+6} + 2e^- \rightarrow S^{+4}$

A. oxidation ; go to #7
B. protonation ; go to #1
C. reduction ; go to #19
D. deprotonation ; go to #14

Question 17

Identify the oxidation number of Zn.

A. +2 ; go to #5
B. 0 ; go to #9
C. -2 ; go to #12
D. +1 ; go to #16

Question 18

What happened to a substance if the oxidation state change from -2 to 0?

A. It has gained 3 electrons ; go to #4
B. It gained 2 electrons ; go to #13
C. It was reduced ; go to #6
D. It has lost 2 electrons ; go to #2

Question 19

What is the sum of all the oxidation numbers in $KClO_3$?

A. +1 ; go to #14

B. 0 ; go to #1

C. -1 ; go to #7

D. +7 ; go to #15

Question 20

Which of the following is NOT an oxidation-reduction reaction?

A. $O_2 + 2\ H_2 \rightarrow 2\ H_2O$; go to #9

B. $2\ Na_2O \rightarrow 4\ Na + O_2$; go to #17

C. $Fe + 2\ HCl \rightarrow FeCl_2 + H_2$; go to #10

D. $CaCl_2 + 2\ AgNO_3 \rightarrow 2\ AgCl + Ca(NO_3)_2$; go to #3

Redox
20-Question Trail Answer Key

Begin anywhere

Q	11	8	18	2	6	13	4	20	3	10	17	9	5	12	16	19	1	14	7	15
A	B	D	D	C	A	B	C	D	C	A	B	A	A	B	C	B	A	A	D	B

Loops back to 11

Question 1

Identify the oxidation number of $\underline{Cl}_2$.

(A.) 0 ; go to #14
B. +2 ; go to #7
C. -1 ; go to #15
D. -2 ; go to #11

Question 2

What does the following half-reaction show?
$Zn(s) \rightarrow Zn^{2+}(aq) + 2\ e^-$

A. gain of electrons ; go to #4
B. donation of a proton ; go to #20
(C.) oxidation ; go to #6
D. reduction ; go to #13

Question 3

Identify the oxidation number of Fe in $\underline{FeCl}_2$.

A. +1 ; go to #9
B. -2 ; go to #17
(C.) +2 ; go to #10
D. -1 ; go to #5

Question 4

Identify what is **reduced** in the reaction below:
$P_4 + 6\ Br_2 \rightarrow 4\ PBr_3$

A. P^{3+} ; go to #10
B. P ; go to #3
(C.) Br_2 ; go to #20
D. Br^- ; go to #17

Question 5

Identify the oxidation number of Cl in $\underline{Cl}O_2^{1-}$.

(A.) +3 ; go to #12
B. +4 ; go to #16
C. -1 ; go to #19
D. +1 ; go to #1

Question 6

Identify the oxidation number of $\underline{Na}$.

(A.) 0 ; go to #13
B. -1 ; go to #4
C. +1 ; go to #20
D. +2 ; go to #3

Question 7

What has happened to a substance if its oxidation state changed from +4 to +7?

A. It has gained 3 electrons ; go to #11
B. It has gained 2 protons ; go to #8
C. It was reduced ; go to #18
(D.) It has lost 3 electrons ; go to #15

Question 8

Identify what is **oxidized** in the reaction below:
$2\ HCl(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + CaCl_2(aq)$

A. O^{2-} ; go to #2
B. Cl^- ; go to #6
C. H^+ ; go to #13
(D.) Nothing, it is not a redox reaction; go to #18

Answer Key Continued

Question 9

Identify the oxidation number of N in $Mg(\underline{N}O_3)_2$.

(A.) +5 ; go to #5
B. +3 ; go to #12
C. -3 ; go to #16
D. -2 ; go to #19

Question 10

True or False: A substance that is oxidized has lost electrons.

(A.) True ; go to #17
B. False ; go to #9

Question 11

To balance the following half-reaction, how many electrons and on which side should they be added?
$Li^+(aq) \rightarrow Li(s)$

A. 2 electrons on the product side ; go to #18
(B.) 1 electron on the reactant side ; go to #8
C. 2 electrons on the reactant side ; go to #2
D. 1 electron on the product side ; go to #6

Question 12

Identify what is **oxidized** in the reaction below:
$Fe(s) + Cu(NO_3)_2(aq) \rightarrow 2\ Cu(s) + Fe(NO_3)_2(aq)$

A. $Cu^{2+}(aq)$; go to #19
(B.) $Fe(s)$; go to #16
C. $N^{5+}(aq)$; go to #1
D. $Cu(s)$; go to #14

Question 13

To balance the following half-reaction, how many electrons and on which side should they be added?
$O_2(g) \rightarrow 2\ O^{2-}(aq)$

A. 2 electrons on the product side ; go to #20
(B.) 4 electrons on the reactant side ; go to #4
C. 2 electrons on the reactant side ; go to #3
D. 4 electrons on the product side ; go to #10

Question 14

Assign oxidation numbers to each element in the following redox reaction:
$Mg(s) + 2\ HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

(A.) 0; +1,-1; +2,-1; 0 ; go to #7
B. +2; +1,-1; +2,-1; 0 ; go to #15
C. +2; +1,-1; +2,-1; +1 ; go to #11
D. 0; +1,-1; +2,-1; +1 ; go to #8

Question 15

Identify the oxidation number of Pb in $\underline{Pb}S_2$.

A. -4 ; go to #2
(B.) +4 ; go to #11
C. -3 ; go to #8
D. +3 ; go to #18

Question 16

What process is shown in the half-reaction below?
$S^{+6} + 2e^- \rightarrow S^{+4}$

A. oxidation ; go to #7
B. protonation ; go to #1
(C.) reduction ; go to #19
D. deprotonation ; go to #14

Question 17

Identify the oxidation number of $\underline{Zn}$.

A. +2 ; go to #5
(B.) 0 ; go to #9
C. -2 ; go to #12
D. +1 ; go to #16

Question 18

What happened to a substance if the oxidation state change from -2 to 0?

A. It has gained 3 electrons ; go to #4
B. It gained 2 electrons ; go to #13
C. It was reduced ; go to #6
(D.) It has lost 2 electrons ; go to #2

Question 19

What is the sum of all the oxidation numbers in $KClO_3$?

A. +1 ; go to #14
(B.) 0 ; go to #1
C. -1 ; go to #7
D. +7 ; go to #15

Question 20

Which of the following is NOT an oxidation-reduction reaction?

A. $O_2 + 2\ H_2 \rightarrow 2\ H_2O$; go to #9
B. $2\ Na_2O \rightarrow 4\ Na + O_2$; go to #17
C. $Fe + 2\ HCl \rightarrow FeCl_2 + H_2$; go to #10
(D.) $CaCl_2 + 2\ AgNO_3 \rightarrow 2\ AgCl + Ca(NO_3)_2$; go to #3

Electrochemistry Question Trail Name: _____ Pd:____

Begin your trailblazing at any question and then based on your answer choice, travel to the question number it directs you to. Fill in your trail below, keeping record of your answer choices and thought process. If you answer all questions correctly, you will complete a full circuit of all the questions, ending your trail at the station where you started. If you answer a question incorrectly and are told to visit a station you already have visited, you need to backtrack to the question you first missed. Try your best to backtrack and correct your mistakes, but if you get too far off the trail, ask for help! Keep track of your trail below:

Q																			
A																			

Workspace:
Record your station number & show your work below.

Reflection: Circle the number of how you feel after this question trail.

4	I can do it without mistakes. I can help others.	Explain.
3	I can do it by myself. I make little mistakes.	
2	Sometimes I need help and have some questions.	
1	I can't do it by myself. I don't understand yet.	

Electrochemistry Question Trail Name: _____ Pd:____

Begin your trailblazing at any question and then based on your answer choice, travel to the question number it directs you to. Fill in your trail below, keeping record of your answer choices and thought process. If you answer all questions correctly, you will complete a full circuit of all the questions, ending your trail at the station where you started. If you answer a question incorrectly and are told to visit a station you already have visited, you need to backtrack to the question you first missed. Try your best to backtrack and correct your mistakes, but if you get too far off the trail, ask for help! Keep track of your trail below:

Q																			
A																			

Workspace:
Record your station number & show your work below.

Reflection: Circle the number of how you feel after this question trail.

4	I can do it without mistakes. I can help others.	Explain.
3	I can do it by myself. I make little mistakes.	
2	Sometimes I need help and have some questions.	
1	I can't do it by myself. I don't understand yet.	

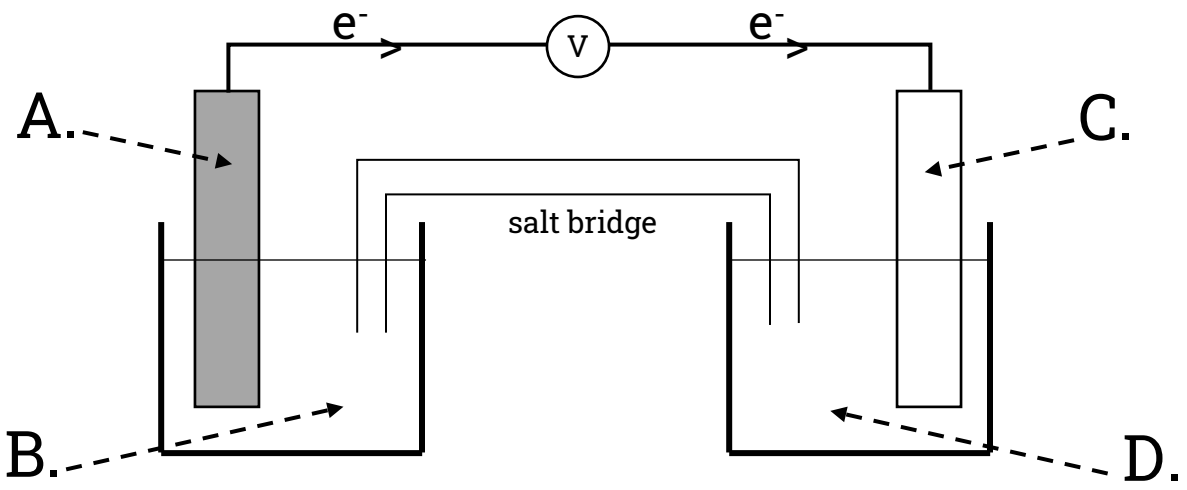
Question 1

What is the purpose of the salt bridge?

A. It permits the two solutions to mix completely ; go to #9
B. It maintains electrical neutrality in the half-cells via migration of ions ; go to #17
C. It prevents the migration of electrons ; go to #4
D. It prevents the reaction from naturally occurring ; go to #3

Question 2

Identify the **anode** in the cell (battery) below:



A. A ; go to #20
B. B ; go to #7
C. C ; go to #11
D. D ; go to #16

Question 3

How many moles of electrons will be transferred for the reaction between Fe & Cu?

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ E°= -0.44 V
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ E°= 0.34 V

A. 1 moles of e^- ; go to #2
B. 4 moles of e^- ; go to #18
C. 2 moles of e^- ; go to #13
D. 8 moles of e^- ; go to #20

Question 4

True or False: The anode will gain mass as a battery operates.

A. True ; go to #13
B. False ; go to #3

Question 5

What process is happening at the **cathode** of a fuel cell, which uses the following reaction to generate electricity?

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

A. Hydrogen is being reduced ; go to #8
B. Hydrogen is being oxidized ; go to #14
C. Oxygen is being reduced ; go to #10
D. Nothing is happening there ; go to #19

Question 6

From the given standard reduction potentials, calculate the electrical cell potential.

$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$ E°= -0.14 V
$K^+(aq) + e^- \rightarrow K(s)$ E°= -2.93 V

A. 2.79 V ; go to #12
B. 3.07 V ; go to #15
C. -2.79 V ; go to #1
D. -3.07 V ; go to #17

Question 7

In a battery, the anode is

A. the positive electrode ; go to #5
B. the electrode at which electrons are gained ; go to #16
C. the electrode at which electrons are lost ; go to #11
D. all of the above ; go to #10

Question 8

True or False: The *higher* the standard reduction potential, the *less likely* the metal will be reduced.

A. True ; go to #6

B. False ; go to #19

Question 9

If a piece of zinc metal is placed into a $Cu(NO_3)_2$ solution and copper begins to plate out, which of the following is true?

A. Nothing about the standard reduction potentials of Zn^{2+} and Cu^{2+} can be determined; go to #18

B. Zn^{2+} and Cu^{2+} have the same standard reduction potential ; go to #13

C. Zn^{2+} has a higher standard reduction potential than Cu^{2+} ; go to #3

D. Cu^{2+} has a higher standard reduction potential than Zn^{2+} ; go to #4

Question 10

Galvanic cells (batteries) convert

A. chemical energy into electrical energy ; go to #14
B. mechanical energy into electrical energy ; go to #8
C. electrical energy into chemical energy ; go to #19
D. potential energy into chemical energy ; go to #6

Question 11

From the given standard reduction potentials, what is the overall redox reaction?

$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$ E°= -1.66 V

$Ni^{2+}(aq) + 2e^- \rightarrow Ni(s)$ E°= -0.23 V

A. $2\ Al^{3+}(aq) + 3\ Ni^{2+}(aq) \rightarrow 2\ Al(s) + 3\ Ni(s)$; go to #10

B. $2\ Al(s) + 3\ Ni(s) \rightarrow 2\ Al^{3+}(aq) + 3\ Ni^{2+}(aq)$; go to #5

C. $2\ Al(s) + 3\ Ni^{2+}(aq) \rightarrow 2\ Al^{3+}(aq) + 3\ Ni(s)$; go to #16

D. $2\ Al^{3+}(aq) + 3\ Ni(s) \rightarrow 2\ Al(s) + 3\ Ni^{2+}(aq)$; go to #14

Question 12

As a battery operates, which of the following occurs?

A. voltage increases *;* go to #9
B. No change in voltage occurs ; go to #17
C. voltage first increases, then decreases ; go to #1
D. voltage decreases but remains above zero ; go to #15

Question 13

Describe the flow of electrons as a galvanic (battery) cell operates.

A. They move through a wire to the cathode ; go to #18
B. They move through the salt bridge to the cathode ; go to #2
C. They move through the salt bridge to the anode ; go to #7
D. They move through a wire to the anode ; go to #20

Question 14

From the given standard reduction potentials, which species will be oxidized?

$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ E°= -0.74 V

$Na^+(aq) + e^- \rightarrow Na(s)$ E°= -2.71 V

A. $Cr(s)$; go to #12

B. $Na^+(aq)$; go to #6

C. $Cr^{3+}(aq)$; go to #19

D. $Na(s)$; go to #8

Question 15

As the following redox reaction occurs, what will happen to the concentration of Ag^+ over time?

$$2\ Ag^+(aq) + Ni(s) \rightarrow Ni^{2+}(aq) + 2\ Ag(s)$$

A. It will decrease ; go to #1
B. It cannot be determined ; go to #17
C. It will increase ; go to #9
D. It will decrease, then begin to increase ; go to #4

Question 16

When the following redox reaction occurs:
$2\ P + 3\ Ca \rightarrow Ca_3P_2$,
in what direction are **electrons** transferred?

A. From P to P^{3-} ; go to #10
B. From Ca to P ; go to #5
C. No electrons are transferred ; go to #14
D. From P to Ca ; go to #8

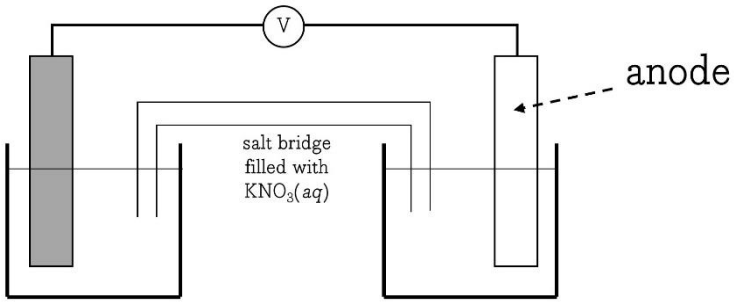
Question 17

A galvanic (battery) cell operates with the overall redox reaction:
$2\ Ag^{+}(aq) + Cu(s) \rightarrow 2\ Ag(s) + Cu^{2+}(aq)$
What is the half-reaction that occurs at the anode?

A. $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^{-}$; go to #9
B. $Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$; go to #4
C. $Ag(s) \rightarrow Ag^{+}(aq) + e^{-}$; go to #3
D. $Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$; go to #13

Question 18

The anode is labeled in the cell diagram below. In what direction will the NO_3^- in the salt bridge flow as the cell operates?



A. The NO_3^- will not move ; go to #20
B. To the right towards the anode; go to #2
C. To the left towards the cathode; go to #11
D. The NO_3^- will move in both directions ; go to #7

Question 19

Based off the standard reduction potentials below, what will happen when an iron nail is placed into a $Au(NO_3)_3$ solution?

$Au^{3+}(aq) + 3e^- \rightarrow Au(s)$ $\quad E° = 1.50\ V$

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ $\quad E° = -0.44\ V$

A. More gold ions will be formed; go to #12
B. Gold will plate out onto the nail ; go to #6
C. An acid-base reaction will occur ; go to #15
D. No reaction will occur ; go to #1

Question 20

What is a galvanic (voltaic) cell?

A. It is a cell that destroys electrons on one side and creates electrons on the other side ; go to #11
B. It is a type of battery that generates an electrical current from redox reactions ; go to #7
C. It is a type of battery that drives a redox reaction when electricity is applied ; go to #16
D. It is a cell that contains only one metal bar and one aqueous ion solution ; go to #5

Electrochemistry
20-Question Trail Answer Key

Begin anywhere

Q	17	9	4	3	13	18	2	20	7	11	16	5	10	14	8	19	6	12	15	1
A	A	D	B	C	A	B	A	B	C	C	B	C	A	D	B	B	A	D	A	B

Loops back to 17

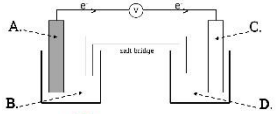
Question 1

What is the purpose of the salt bridge?

A. It permits the two solutions to mix completely ; go to #9
(B.) It maintains electrical neutrality in the half-cells via migration of ions ; go to #17
C. It prevents the migration of electrons ; go to #4
D. It prevents the reaction from naturally occurring ; go to #3

Question 2

Identify the **anode** in the cell (battery) below:



(A.) A ; go to #20
B. B ; go to #7
C. C ; go to #11
D. D ; go to #16

Question 3

How many moles of electrons will be transferred for the reaction between Fe & Cu?

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ $E°= -0.44$ V
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ $E°= 0.34$ V

A. 1 moles of e^- ; go to #2
B. 4 moles of e^- ; go to #18
(C.) 2 moles of e^- ; go to #13
D. 8 moles of e^- ; go to #20

Question 4

True or False: The anode will gain mass as a battery operates.

A. True ; go to #13
(B.) False ; go to #3

Question 5

What process is happening at the **cathode** of a fuel cell, which uses the following reaction to generate electricity?
$2\ H_2 + O_2 \rightarrow 2\ H_2O$

A. Hydrogen is being reduced ; go to #8
B. Hydrogen is being oxidized ; go to #14
(C.) Oxygen is being reduced ; go to #10
D. Nothing is happening there ; go to #19

Question 6

From the given standard reduction potentials, calculate the electrical cell potential.

$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$ $E°= -0.14$ V
$K^+(aq) + e^- \rightarrow K(s)$ $E°= -2.93$ V

(A.) 2.79 V ; go to #12
B. 3.07 V ; go to #15
C. -2.79 V ; go to #1
D. -3.07 V ; go to #17

Question 7

In a battery, the anode is

A. the positive electrode ; go to #5
B. the electrode at which electrons are gained ; go to #16
(C.) the electrode at which electrons are lost ; go to #11
D. all of the above ; go to #10

Question 8

True or False: The *higher* the standard reduction potential, the *less likely* the metal will be reduced.

A. True ; go to #6
(B.) False ; go to #19

Answer Key Continued

Question 9

If a piece of zinc metal is placed into a $Cu(NO_3)_2$ solution and copper begins to plate out, which of the following is true?

A. Nothing about the standard reduction potentials of Zn^{2+} and Cu^{2+} can be determined; go to #18
B. Zn^{2+} and Cu^{2+} have the same standard reduction potential ; go to #13
C. Zn^{2+} has a higher standard reduction potential than Cu^{2+} ; go to #3
D. Cu^{2+} has a higher standard reduction potential than Zn^{2+} ; go to #4

Question 10

Galvanic cells (batteries) convert

A. chemical energy into electrical energy ; go to #14
B. mechanical energy into electrical energy ; go to #8
C. electrical energy into chemical energy ; go to #19
D. potential energy into chemical energy ; go to #6

Question 11

From the given standard reduction potentials, what is the overall redox reaction?

$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$ $\quad E°= -1.66$ V
$Ni^{2+}(aq) + 2e^- \rightarrow Ni(s)$ $\quad E°= -0.23$ V

A. $2\ Al^{3+}(aq) + 3\ Ni^{2+}(aq) \rightarrow 2\ Al(s) + 3\ Ni(s)$; go to #10
B. $2\ Al(s) + 3\ Ni(s) \rightarrow 2\ Al^{3+}(aq) + 3\ Ni^{2+}(aq)$; go to #5
C. $2\ Al(s) + 3\ Ni^{2+}(aq) \rightarrow 2\ Al^{3+}(aq) + 3\ Ni(s)$; go to #16
D. $2\ Al^{3+}(aq) + 3\ Ni(s) \rightarrow 2\ Al(s) + 3\ Ni^{2+}(aq)$; go to #14

Question 12

As a battery operates, which of the following occurs?

A. voltage increases ; go to #9
B. No change in voltage occurs ; go to #17
C. voltage first increases, then decreases ; go to #1
D. voltage decreases but remains above zero ; go to #15

Question 13

Describe the flow of electrons as a galvanic (battery) cell operates.

A. They move through a wire to the cathode ; go to #18
B. They move through the salt bridge to the cathode ; go to #2
C. They move through the salt bridge to the anode ; go to #7
D. They move through a wire to the anode ; go to #20

Question 14

From the given standard reduction potentials, which species will be oxidized?

$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ $\quad E°= -0.74$ V
$Na^+(aq) + e^- \rightarrow Na(s)$ $\quad E°= -2.71$ V

A. $Cr(s)$; go to #12
B. $Na^+(aq)$; go to #6
C. $Cr^{3+}(aq)$; go to #19
D. $Na(s)$; go to #8

Question 15

As the following redox reaction occurs, what will happen to the concentration of Ag^+ over time?
$2\ Ag^+(aq) + Ni(s) \rightarrow Ni^{2+}(aq) + 2\ Ag(s)$

A. It will decrease ; go to #1
B. It cannot be determined ; go to #17
C. It will increase ; go to #9
D. It will decrease, then begin to increase ; go to #4

Question 16

When the following redox reaction occurs:
$2\ P + 3\ Ca \rightarrow Ca_3P_2$,
in what direction are **electrons** transferred?

A. From P to P^{3-} ; go to #10
B. From Ca to P ; go to #5
C. No electrons are transferred ; go to #14
D. From P to Ca ; go to #8

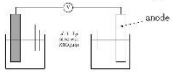
Question 17

A galvanic (battery) cell operates with the overall redox reaction:
$2\ Ag^+(aq) + Cu(s) \rightarrow 2\ Ag(s) + Cu^{2+}(aq)$
What is the half-reaction that occurs at the anode?

A. $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$; go to #9
B. $Ag^+(aq) + e^- \rightarrow Ag(s)$; go to #4
C. $Ag(s) \rightarrow Ag^+(aq) + e^-$; go to #3
D. $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$; go to #13

Question 18

The anode is labeled in the cell diagram below. In what direction will the NO_3^- in the salt bridge flow as the cell operates?



A. The NO_3^- will not move ; go to #20
B. To the right towards the anode; go to #2
C. To the left towards the cathode; go to #11
D. The NO_3^- will move in both directions ; go to #7

Question 19

Based off the standard reduction potentials below, what will happen when an iron nail is placed into a $Au(NO_3)_3$ solution?

$Au^{3+}(aq) + 3e^- \rightarrow Au(s)$ $\quad E°= 1.50$ V
$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ $\quad E°= -0.44$ V

A. More gold ions will be formed; go to #12
B. Gold will plate out onto the nail ; go to #6
C. An acid-base reaction will occur ; go to #15
D. No reaction will occur ; go to #1

Question 20

What is a galvanic (voltaic) cell?

A. It is a cell that destroys electrons on one side and creates electrons on the other side ; go to #11
B. It is a type of battery that generates an electrical current from redox reactions ; go to #7
C. It is a type of battery that drives a redox reaction when electricity is applied ; go to #16
D. It is a cell that contains only one metal bar and one aqueous ion solution ; go to #5