

# **Chemistry 1**

## **Volume 4**

### **Worksheet 20**

**Balancing Redox Reactions in Acidic Solution**

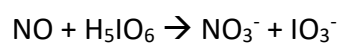
**Ion/Electron Method**

**Part 5**

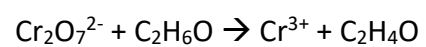
*Rules for balancing redox reactions in acidic solution:*

1. Write the net ionic equation.
2. Write half-reactions.
3. Balance atoms other than hydrogen and oxygen.
4. Balance oxygen by adding  $\text{H}_2\text{O}$ .
5. Balance H by adding  $\text{H}^+$ .
6. Balance the charges by adding  $\text{e}^-$ .
  - a. Add up the total charge on each side.
  - b. Add electrons to the more positive side to balance the charge on both sides.
7. Multiply to balance the electrons gained/lost between the two half-reactions and add reactions together.
8. Cancel common species on both sides of the reaction.

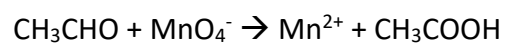
1. Balance the redox reaction below that is in acidic solution:



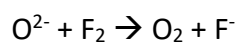
2. Balance the redox reaction below that is in acidic solution:



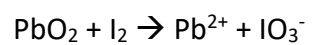
3. Balance the redox reaction below that is in acidic solution:



4. Balance the redox reaction below that is in acidic solution:

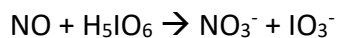


5. Balance the redox reaction below that is in acidic solution:



## Answer Key

1. Balance the redox reaction below that is in acidic solution:

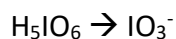
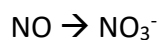


*Step 1:*

The net ionic equation is already written, so we can go to rule 2.

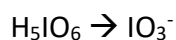
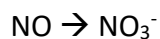
*Step 2:*

Break into half-reactions.



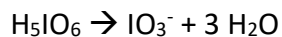
*Step 3:*

All elements other than O or H are already balanced.



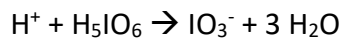
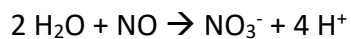
*Step 4:*

Balance O by adding  $\text{H}_2\text{O}$ .



*Step 5:*

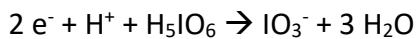
Balance H by adding  $\text{H}^+$ .





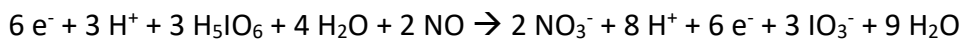
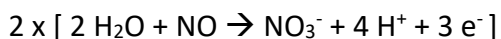
*Step 6:*

Balance charges by adding  $e^-$ .



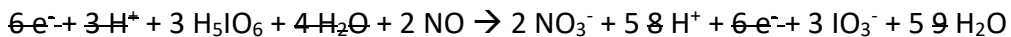
*Step 7:*

Multiply the half-reactions in order to balance electrons and add them together.

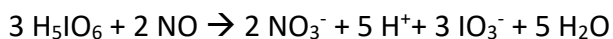


*Step 8:*

Cancel common species.



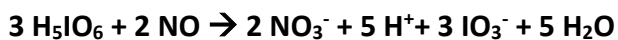
Now is a good time to make sure all elements and charges are balanced.



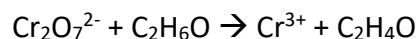
Reactants		Products	
H	15	H	15
I	3	I	3
O	20	O	20
N	2	N	2
Charge	0	Charge	0

Everything is balanced!

**Correct answer:**



2. Balance the redox reaction below that is in acidic solution:

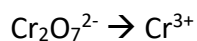
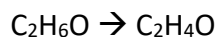


*Step 1:*

The net ionic equation is already written, so we can go to rule 2.

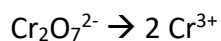
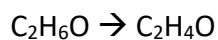
*Step 2:*

Break into half-reactions.



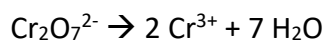
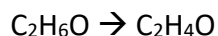
*Step 3:*

Balance all elements other than O or H.



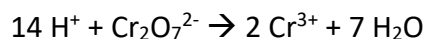
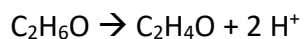
*Step 4:*

Balance O by adding  $\text{H}_2\text{O}$ .



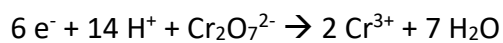
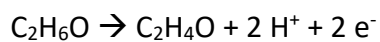
*Step 5:*

Balance H by adding  $\text{H}^+$ .



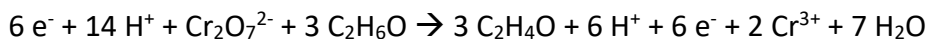
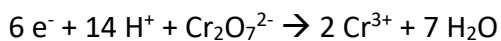
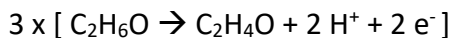
*Step 6:*

Balance charges by adding  $\text{e}^-$ .



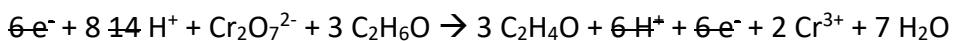
*Step 7:*

Multiply the half-reactions in order to balance electrons and add them together.



*Step 8:*

Cancel common species.



Make sure all elements and charges are balanced.



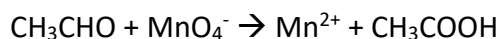
Reactants		Products	
H	26	H	26
Cr	2	Cr	2
O	10	O	10
C	6	C	6
Charge	+6	Charge	+6

Everything is balanced!

**Correct answer:**



3. Balance the redox reaction below that is in acidic solution:

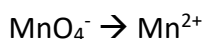
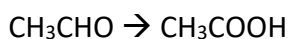


*Step 1:*

The net ionic equation is already written, so we can go to rule 2.

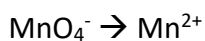
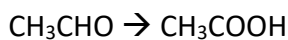
*Step 2:*

Break into half-reactions.



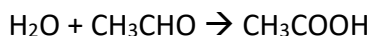
*Step 3:*

All elements other than O or H are already balanced.



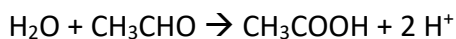
*Step 4:*

Balance O by adding  $\text{H}_2\text{O}$ .



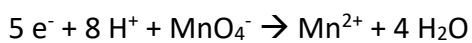
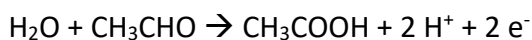
*Step 5:*

Balance H by adding  $\text{H}^+$ .



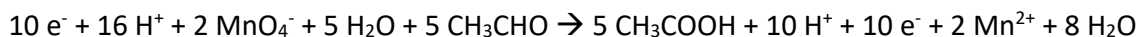
*Step 6:*

Balance charges by adding  $\text{e}^-$ .



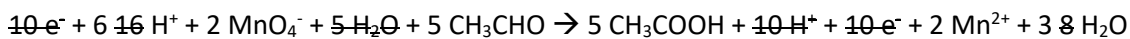
*Step 7:*

Multiply the half-reactions in order to balance electrons and add them together.

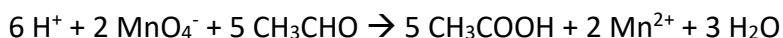


*Step 8:*

Cancel common species.



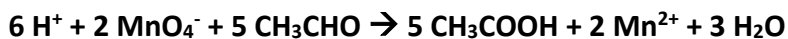
Make sure all elements and charges are balanced.



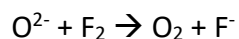
Reactants		Products	
H	26	H	26
Mn	2	Mn	2
O	13	O	13
C	10	C	10
Charge	+4	Charge	+4

Everything is balanced!

**Correct answer:**



4. Balance the redox reaction below that is in acidic solution:

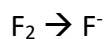
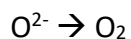


*Step 1:*

The net ionic equation is already written, so we can go to rule 2.

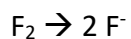
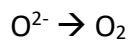
*Step 2:*

Break into half-reactions.



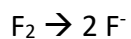
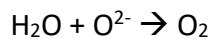
*Step 3:*

Balance all elements other than O or H.



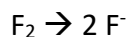
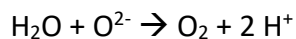
*Step 4:*

Balance O by adding  $\text{H}_2\text{O}$ .



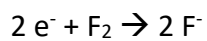
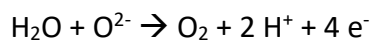
*Step 5:*

Balance H by adding  $\text{H}^+$ .



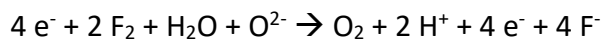
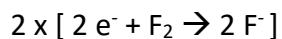
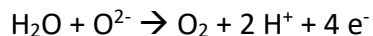
*Step 6:*

Balance charges by adding  $\text{e}^-$ .



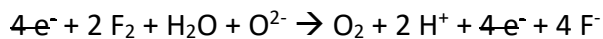
*Step 7:*

Multiply the half-reactions in order to balance electrons and add them together.

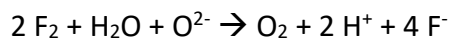


*Step 8:*

Cancel common species.



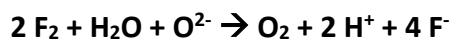
Make sure all elements and charges are balanced.



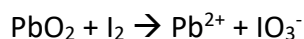
Reactants		Products	
F	4	F	4
H	2	H	2
O	2	O	2
Charge	-2	Charge	-2

Everything is balanced!

**Correct answer:**



5. Balance the redox reaction below that is in acidic solution:

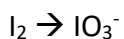
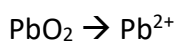


*Step 1:*

The net ionic equation is already written, so we can go to rule 2.

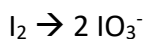
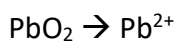
*Step 2:*

Break into half-reactions.



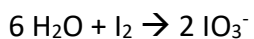
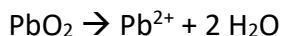
*Step 3:*

Balance all elements other than O or H.



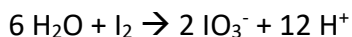
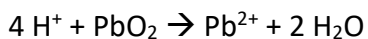
*Step 4:*

Balance O by adding  $\text{H}_2\text{O}$ .



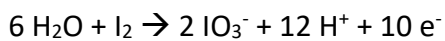
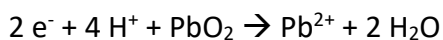
*Step 5:*

Balance H by adding  $\text{H}^+$ .



*Step 6:*

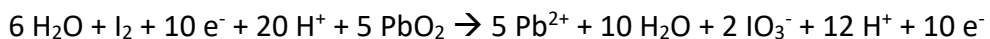
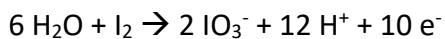
Balance charges by adding  $\text{e}^-$ .





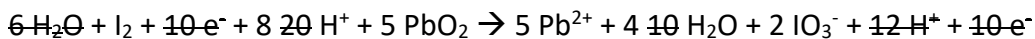
*Step 7:*

Multiply the half-reactions in order to balance electrons and add them together.

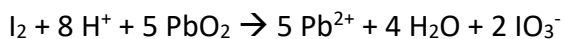


*Step 8:*

Cancel common species.



Make sure all elements and charges are balanced.



Reactants		Products	
I	2	I	2
H	8	H	8
Pb	5	Pb	5
O	10	O	10
Charge	+8	Charge	+8

Everything is balanced!

**Correct answer:**

