

The HilbertBalance.wl file should be placed in the same directory as this file. Before proceeding, ensure that Normaliz (<https://www.normaliz.uni-osnabrueck.de/>) is installed and specify the full path of normaliz.exe, and run the following line to import HilbertBalance. (For Mac and Linux OS, the file name may differ. At present, normaliz-3.9.4 was well tested for HilbertBalance (<https://github.com/Normaliz/Normaliz/releases/tag/v3.9.4>)).

```
In[*]:= SetDirectory[NotebookDirectory[]];
<< "HilbertBalance`";
NormalizPath =
  "D:\\bak-HP-GAME\\Mathematica\\BalanceBand\\normaliz-3.9.4\\normaliz.exe";
(*NormalizPath= "/Users/zhang/Downloads/normaliz-3.9.4/normaliz";*)
```



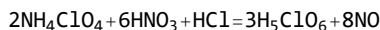
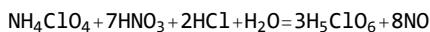
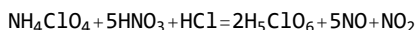
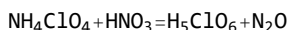
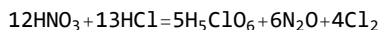
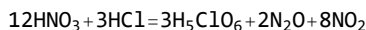
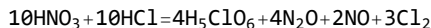
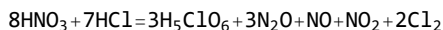
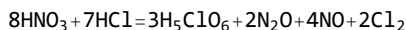
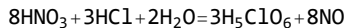
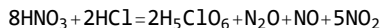
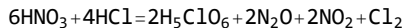
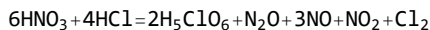
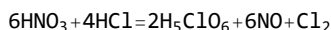
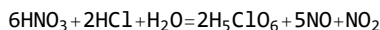
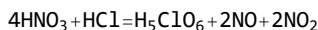
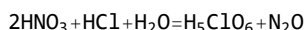
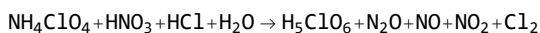
```
In[*]:= HilbertBalance["ClO3+Cl+H->ClO2+Cl2+H2O", "Charge" -> {-1, -1, 1, 0, 0, 0}]

ClO3-1+Cl-1+H+1→ClO2+Cl2+H2O
ClO3-1+5Cl-1+6H+1=3Cl2+3H2O
2ClO3-1+2Cl-1+4H+1=2ClO2+Cl2+2H2O
5ClO3-1+Cl-1+6H+1=6ClO2+3H2O

In[*]:= balanceMatrix["ClO3+Cl+H->ClO2+Cl2+H2O", "Charge" -> {-1, -1, 1, 0, 0, 0}]
Out[*]:=
<|M -> {{1, 1, 0, -1, -2, 0}, {0, 0, 1, 0, 0, -2},
  {3, 0, 0, -2, 0, -1}, {-1, -1, 1, 0, 0, 0}}, Elements -> {Cl, H, O, Charge},
Compounds -> <|1 -> <|ClO3 -> <|Cl -> 1, 0 -> 3, Charge -> -1|>, Cl -> <|Cl -> 1, Charge -> -1|>,
  H -> <|H -> 1, Charge -> 1|>|>, 2 -> <|ClO2 -> <|Cl -> 1, 0 -> 2, Charge -> 0|>,
  Cl2 -> <|Cl -> 2, Charge -> 0|>, H2O -> <|H -> 2, 0 -> 1, Charge -> 0|>|>|>,
TableHead -> {{ClO3, Cl, H, ClO2, Cl2, H2O}, {Cl, H, O, Charge}},
Null -> {{5, 1, 6, 6, 0, 3}, {-4, 4, 0, -6, 3, 0}},
HilbertBasis ->
  <|N -> 3, Hilb -> {{1, 5, 6, 0, 3, 3}, {2, 2, 4, 2, 1, 2}, {5, 1, 6, 6, 0, 3}}|>|>
```



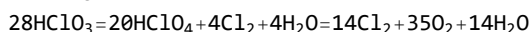
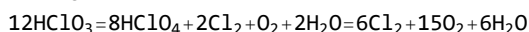
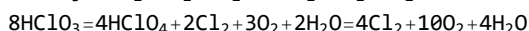
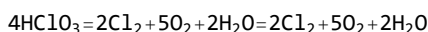
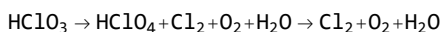
```
In[*]:= HilbertBalance["NH4ClO4+HNO3+HCl+H2O->H5ClO6+N2O+NO+NO2+Cl2"]
```



```
In[*]:= balanceMatrix["NH4ClO4+HNO3+HCl+H2O->H5ClO6+N2O+NO+NO2+Cl2"]
Out[*]=
<|M -> {{1, 0, 1, 0, -1, 0, 0, 0, -2}, {4, 1, 1, 2, -5, 0, 0, 0, 0},
{1, 1, 0, 0, 0, -2, -1, -1, 0}, {4, 3, 0, 1, -6, -1, -1, -2, 0}},
Elements -> {Cl, H, N, O}, Compounds -> <|1 -> <|NH4ClO4 -> <|N -> 1, H -> 4, Cl -> 1, O -> 4|>,
HNO3 -> <|H -> 1, N -> 1, O -> 3|>, HCl -> <|H -> 1, Cl -> 1|>, H2O -> <|H -> 2, O -> 1|>|>,
2 -> <|H5ClO6 -> <|H -> 5, Cl -> 1, O -> 6|>, N2O -> <|N -> 2, O -> 1|>,
NO -> <|N -> 1, O -> 1|>, NO2 -> <|N -> 1, O -> 2|>, Cl2 -> <|Cl -> 2|>|>|>,
TableHead -> {{NH4ClO4, HNO3, HCl, H2O, H5ClO6, N2O, NO, NO2, Cl2}, {Cl, H, N, O}},
Null -> {{-6, 6, 13, 0, -1, 0, 0, 0, 4}, {-2, 10, 3, 0, 1, 0, 0, 8, 0}},
{2, 6, 1, 0, 3, 0, 8, 0, 0}, {1, 1, 0, 0, 1, 1, 0, 0, 0}, {-1, 1, 1, 1, 0, 0, 0, 0, 0}},
HilbertBasis -> <|N -> 17, Hilb -> {{0, 2, 1, 1, 1, 1, 0, 0, 0}, {0, 4, 1, 0, 1, 0, 2, 2, 0},
{0, 6, 2, 1, 2, 0, 5, 1, 0}, {0, 6, 4, 0, 2, 0, 6, 0, 1}, {0, 6, 4, 0, 2, 1, 3, 1, 1},
{0, 6, 4, 0, 2, 2, 0, 2, 1}, {0, 8, 2, 0, 2, 1, 1, 5, 0}, {0, 8, 3, 2, 3, 0, 8, 0, 0},
{0, 8, 7, 0, 3, 2, 4, 0, 2}, {0, 8, 7, 0, 3, 3, 1, 1, 2}, {0, 10, 10, 0, 4, 4, 2, 0, 3},
{0, 12, 3, 0, 3, 2, 0, 8, 0}, {0, 12, 13, 0, 5, 6, 0, 0, 4}, {1, 1, 0, 0, 1, 1, 0, 0, 0},
{1, 5, 1, 0, 2, 0, 5, 1, 0}, {1, 7, 2, 1, 3, 0, 8, 0, 0}, {2, 6, 1, 0, 3, 0, 8, 0, 0}}|>|>
```



```
In[*]:= HilbertBalance["HClO3->HClO4+Cl2+O2+H2O->Cl2+O2+H2O"]
```



```
In[*]:= balanceMatrix["HC103->HC104+C12+O2+H2O->C12+O2+H2O"]
Out[*]=
<|M -> {{1, -1, -2, 0, 0, 0, 0, 0}, {1, -1, 0, 0, -2, 0, 0, 0}, {3, -4, 0, -2, -1, 0, 0, 0},
{0, 1, 2, 0, 0, -2, 0, 0}, {0, 1, 0, 0, 2, 0, 0, -2}, {0, 4, 0, 2, 1, 0, -2, -1}},
Elements -> {C1, H, O}, Compounds -> <| 1 -> <| HC103 -> <| H -> 1, C1 -> 1, O -> 3 |> |>,
2 -> <| HC104 -> <| H -> 1, C1 -> 1, O -> 4 |>,
C12 -> <| C1 -> 2 |>, O2 -> <| O -> 2 |>, H2O -> <| H -> 2, O -> 1 |> |>,
3 -> <| C12 -> <| C1 -> 2 |>, O2 -> <| O -> 2 |>, H2O -> <| H -> 2, O -> 1 |> |>,
TableHead -> {{HC103, HC104, C12, O2, H2O, C12, O2, H2O}, {C1, H, O, C1, H, O}},
Null -> {{-4, -4, 0, 2, 0, -2, -5, -2}, {0, 4, -2, -7, -2, 0, 0, 0}},
HilbertBasis -> <| N -> 4, Hilb -> {{4, 0, 2, 5, 2, 2, 5, 2}, {8, 4, 2, 3, 2, 4, 10, 4},
{12, 8, 2, 1, 2, 6, 15, 6}, {28, 20, 4, 0, 4, 14, 35, 14}} |> |>
```

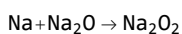


```
In[*]:= HilbertBalance["C2H5NO2+C3H7NO3+C6H14N4O2+C5H9NO2+C9H11NO2->H2O+C50H73N15O11"]
```

```
C2H5NO2+C3H7NO3+C6H14N4O2+C5H9NO2+C9H11NO2 -> H2O+C50H73N15O11
8C3H7NO3+15C6H14N4O2+3C5H9NO2+19C9H11NO2=32H2O+6C50H73N15O11
9C3H7NO3+14C6H14N4O2+9C5H9NO2+16C9H11NO2=39H2O+6C50H73N15O11
10C3H7NO3+13C6H14N4O2+15C5H9NO2+13C9H11NO2=46H2O+6C50H73N15O11
11C3H7NO3+12C6H14N4O2+21C5H9NO2+10C9H11NO2=53H2O+6C50H73N15O11
12C3H7NO3+11C6H14N4O2+27C5H9NO2+7C9H11NO2=60H2O+6C50H73N15O11
13C3H7NO3+10C6H14N4O2+33C5H9NO2+4C9H11NO2=67H2O+6C50H73N15O11
14C3H7NO3+9C6H14N4O2+39C5H9NO2+C9H11NO2=74H2O+6C50H73N15O11
15C3H7NO3+31C6H14N4O2+41C9H11NO2=57H2O+12C50H73N15O11
43C3H7NO3+26C6H14N4O2+123C5H9NO2=229H2O+18C50H73N15O11
C2H5NO2+C3H7NO3+2C6H14N4O2+3C5H9NO2+2C9H11NO2=8H2O+C50H73N15O11
C2H5NO2+8C3H7NO3+18C6H14N4O2+24C9H11NO2=33H2O+7C50H73N15O11
C2H5NO2+16C3H7NO3+10C6H14N4O2+48C5H9NO2=89H2O+7C50H73N15O11
2C2H5NO2+C3H7NO3+5C6H14N4O2+7C9H11NO2=9H2O+2C50H73N15O11
2C2H5NO2+3C3H7NO3+3C6H14N4O2+12C5H9NO2+C9H11NO2=23H2O+2C50H73N15O11
3C2H5NO2+5C3H7NO3+4C6H14N4O2+21C5H9NO2=38H2O+3C50H73N15O11
9C2H5NO2+4C6H14N4O2+18C5H9NO2+2C9H11NO2=33H2O+3C50H73N15O11
10C2H5NO2+7C6H14N4O2+15C5H9NO2+7C9H11NO2=34H2O+4C50H73N15O11
10C2H5NO2+2C3H7NO3+5C6H14N4O2+27C5H9NO2+C9H11NO2=48H2O+4C50H73N15O11
11C2H5NO2+10C6H14N4O2+12C5H9NO2+12C9H11NO2=35H2O+5C50H73N15O11
11C2H5NO2+4C3H7NO3+6C6H14N4O2+36C5H9NO2=63H2O+5C50H73N15O11
12C2H5NO2+13C6H14N4O2+9C5H9NO2+17C9H11NO2=36H2O+6C50H73N15O11
13C2H5NO2+16C6H14N4O2+6C5H9NO2+22C9H11NO2=37H2O+7C50H73N15O11
14C2H5NO2+19C6H14N4O2+3C5H9NO2+27C9H11NO2=38H2O+8C50H73N15O11
15C2H5NO2+22C6H14N4O2+32C9H11NO2=39H2O+9C50H73N15O11
18C2H5NO2+C3H7NO3+7C6H14N4O2+42C5H9NO2+C9H11NO2=73H2O+6C50H73N15O11
19C2H5NO2+3C3H7NO3+8C6H14N4O2+51C5H9NO2=88H2O+7C50H73N15O11
26C2H5NO2+9C6H14N4O2+57C5H9NO2+C9H11NO2=98H2O+8C50H73N15O11
27C2H5NO2+2C3H7NO3+10C6H14N4O2+66C5H9NO2=113H2O+9C50H73N15O11
35C2H5NO2+C3H7NO3+12C6H14N4O2+81C5H9NO2=138H2O+11C50H73N15O11
43C2H5NO2+14C6H14N4O2+96C5H9NO2=163H2O+13C50H73N15O11
```



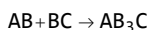
```
In[*]:= HilbertBalance["Na+Na2O->Na2O2"]
```



Can not be balanced.



```
In[*]:= HilbertBalance["AB+BC->AB3C"]
```

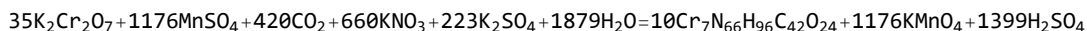
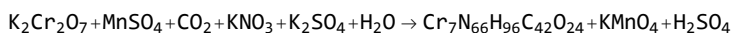


Can not be balanced.

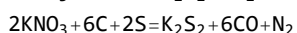
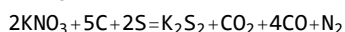
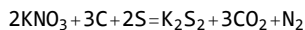
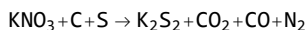


```
In[*]:= HilbertBalance@
```

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"K2Cr2O7 + MnSO4 + CO2 + KNO3 + K2SO4 + H2O -> Cr7N66H96C42O24 + KMnO4 + H2SO4"
```

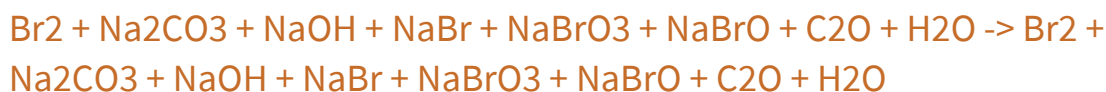
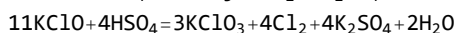
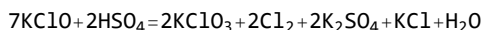
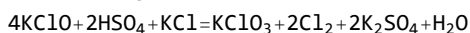
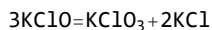
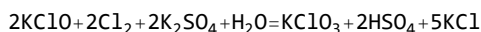
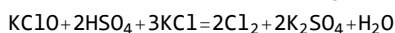
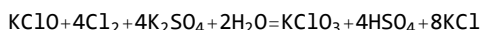
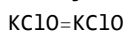
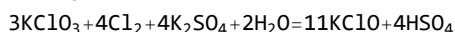
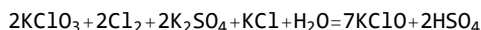
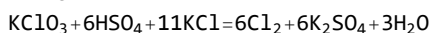
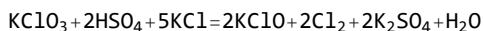
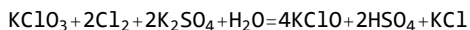
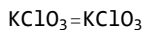
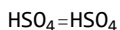
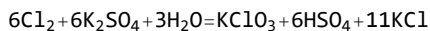
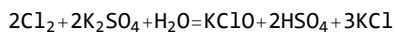
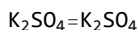
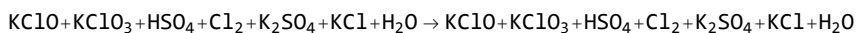


```
In[*]:= HilbertBalance@"KNO3+C+S->K2S2+CO2+CO+N2";
```



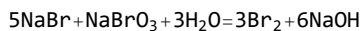
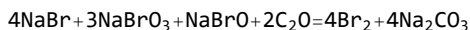
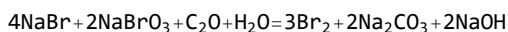
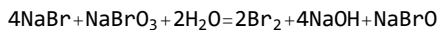
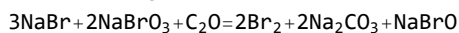
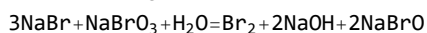
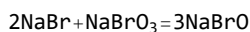
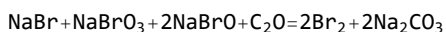
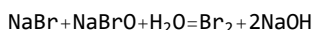
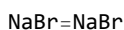
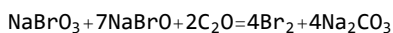
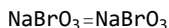
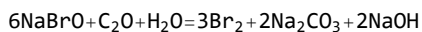
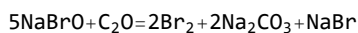
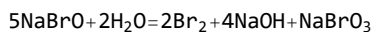
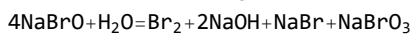
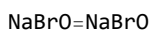
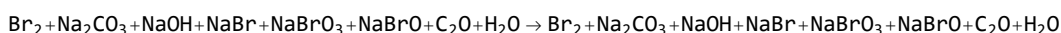
```
In[*]:= HilbertBalance@
```

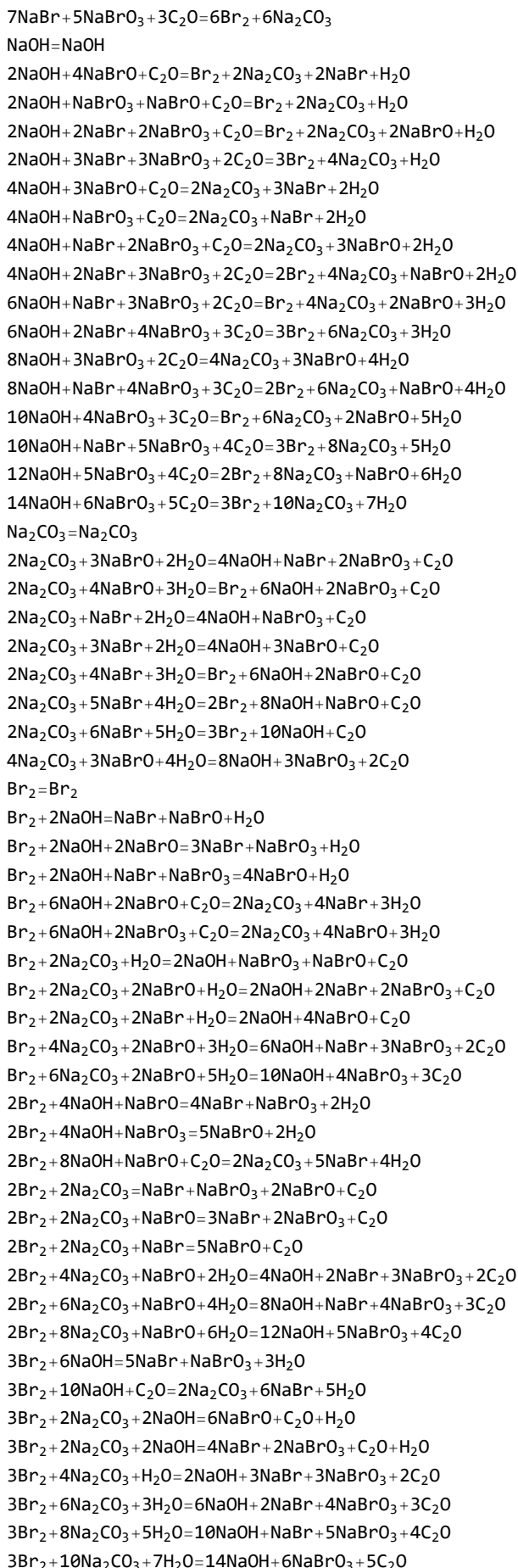
```
"KClO+KClO3+HSO4+Cl2+K2SO4+KCl+H2O->KClO+KClO3+HSO4+Cl2+K2SO4+KCl+H2O";
```

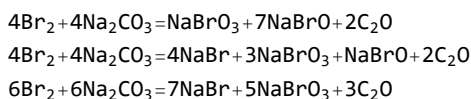


In[]:= HilbertBalance@

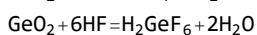
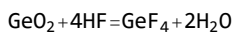
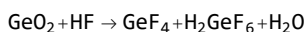
"Br2+Na2CO3+NaOH+NaBr+NaBrO3+NaBrO+C2O+H2O->Br2+Na2CO3+NaOH+NaBr+NaBrO3+NaBrO+C2O+H2O";



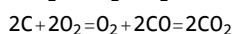
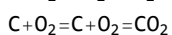
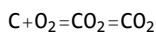
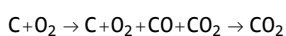




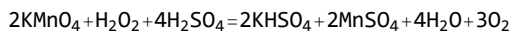
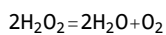
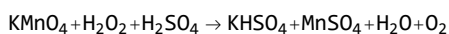
`In[*]:= HilbertBalance["GeO2+HF->GeF4+H2GeF6+H2O"]`



`In[*]:= HilbertBalance["C+O2->C+O2+CO+CO2->CO2"(*,"Format"->"TeX"*)]`



`In[*]:= HilbertBalance["KMnO4+ H2O2 + H2SO4->KHSO4 +MnSO4 + H2O +O2"]`



`In[*]:= HilbertBalance["K2Cr2O7+ H2O2 + H2SO4 -> KHSO4 + Cr2S3O12 + H2O + O2"]`

