Preparations

```
Quit[];
```

```
SetDirectory[NotebookDirectory[]];
```

```
Needs["ReactionKinetics1‘"]; // AbsoluteTiming
```

```
ReactionKinetics Version 1.0 [06-01-2013] using Mathematica
  Version 8.0 for Microsoft Windows (32-bit) (November 7, 2010)
  (Version 8., Release 0) loaded 30 April 2013 at 03:19 GMT+01:59
GNU General Public License (GPLv3) Terms Apply.

Please report reaction kinetics issues or problems at
nagyal@math.bme.hu, dpapp@iems.northwestern.edu, or jtoth@math.bme.hu
```

```
{0.4990285, Null}
```

Hydrogen combustion mechanisms

```
SetDirectory[NotebookDirectory[] <> "hydrogen"];
```

```
ClearAll[hdat, hdata];
hdat = Flatten[Import["names_hydrogen.txt", "Table"]];
hdata = StringReplace[#, ".dat" → ""] & /@ hdat
```

```
{Ahmed2007, Burke2012, CRECK2012, Dagaut2003, Davis2005, GRI30, Hong2011,
 Keromnes2013, Konnov2008, Li2007, NUIG2010, OConaire2004, Rasmussen2008,
 SanDiego2011, SaxenaWilliams2006, Starik2009, Sun2007, USC2007, Zsely2005}
```

```
indices = Range[19];
```

```
TableForm[hdata, TableHeadings → {indices, None}]
```

1	Ahmed2007
2	Burke2012
3	CRECK2012
4	Dagaut2003
5	Davis2005
6	GRI30
7	Hong2011
8	Keromnes2013
9	Konnov2008
10	Li2007
11	NUIG2010
12	OConaire2004
13	Rasmussen2008
14	SanDiego2011
15	SaxenaWilliams2006
16	Starik2009
17	Sun2007
18	USC2007
19	Zsely2005

```
ClearAll[hall];
hall = CHEMKINImport[#]["chemkinreactions"] & /@ hdat; // AbsoluteTiming
```

```
{1.6380937, Null}
```

```
ClearAll[hevery];
hevery = Transpose[{hall, DeleteAutocatalysis /@ hall, hdata}]; //
 AbsoluteTiming
```

```
{0.4320247, Null}
```

```
TableForm[
 ReactionsData[#, ExternalSpecies → {"HV"}]["M", "R", "deficiency"] & /@
  hevery⟦indices, 2⟧,
 TableHeadings → {hevery⟦indices, 3⟧, {"M", "R", "deficiency"}}]
```

	M	R	deficiency
Ahmed2007	8	38	δ=n−l−s=29−11−6=12
Burke2012	8	38	δ=n−l−s=31−12−6=13
CRECK2012	8	37	δ=n−l−s=29−11−6=12
Dagaut2003	8	42	δ=n−l−s=31−12−6=13
Davis2005	8	40	δ=n−l−s=31−12−6=13
GRI30	8	40	δ=n−l−s=31−12−6=13
Hong2011	8	40	δ=n−l−s=31−12−6=13
Keromnes2013	9	42	δ=n−l−s=32−12−7=13
Konnov2008	8	42	δ=n−l−s=31−12−6=13
Li2007	8	38	δ=n−l−s=31−12−6=13
NUIG2010	8	38	δ=n−l−s=31−12−6=13
OConaire2004	8	38	δ=n−l−s=31−12−6=13
Rasmussen2008	8	40	δ=n−l−s=31−12−6=13
SanDiego2011	8	42	δ=n−l−s=31−12−6=13
SaxenaWilliams2006	8	42	δ=n−l−s=31−12−6=13
Starik2009	9	52	δ=n−l−s=41−16−7=18
Sun2007	8	40	δ=n−l−s=31−12−6=13
USC2007	8	40	δ=n−l−s=31−12−6=13
Zsely2005	8	42	δ=n−l−s=31−12−6=13

```
TableForm[
 ReactionsData[#, ExternalSpecies → "HV"]["species"] & /@ hevery⟦indices, 2⟧,
 TableHeadings → {hevery⟦indices, 3⟧, {"list", " of ", "species\n"}}]
```

	list	of	species					
Ahmed2007	H	H2	H2O	OH	H2O2	HO2	O2	O
Burke2012	H	H2	H2O	OH	H2O2	HO2	O2	O
CRECK2012	H2O2	O	HO2	OH	H	H2	H2O	O2
Dagaut2003	H	H2	H2O	OH	H2O2	HO2	O2	O
Davis2005	H	H2	H2O	OH	H2O2	HO2	O2	O
GRI30	H	H2	H2O	OH	H2O2	HO2	O2	O
Hong2011	H	H2	H2O	OH	H2O2	HO2	O2	O
Keromnes2013	H	H2	H2O	OH	H2O2	HO2	O2	O
Konnov2008	H	H2	H2O	OH	H2O2	HO2	O2	O
Li2007	H	H2	H2O	OH	H2O2	HO2	O2	O
NUIG2010	H	H2	H2O	OH	H2O2	HO2	O2	O
OConaire2004	H	H2	H2O	OH	H2O2	HO2	O2	O
Rasmussen2008	H	H2	H2O	OH	H2O2	HO2	O2	O
SanDiego2011	H	H2	H2O	OH	H2O2	HO2	O2	O
SaxenaWilliams2006	H	H2	H2O	OH	H2O2	HO2	O2	O
Starik2009	H	H2	H2O	OH	H2O2	HO2	O2	O
Sun2007	H	H2	H2O	OH	H2O2	HO2	O2	O
USC2007	H	H2	H2O	OH	H2O2	HO2	O2	O
Zsely2005	H	H2	H2O	OH	H2O2	HO2	O2	O

```
TableForm[Table[hevery[[i, 2]] /. x_Equilibrium → Sequence[], {i, 19}],
 TableHeadings → {hevery[[indices, 3]], None}]
```

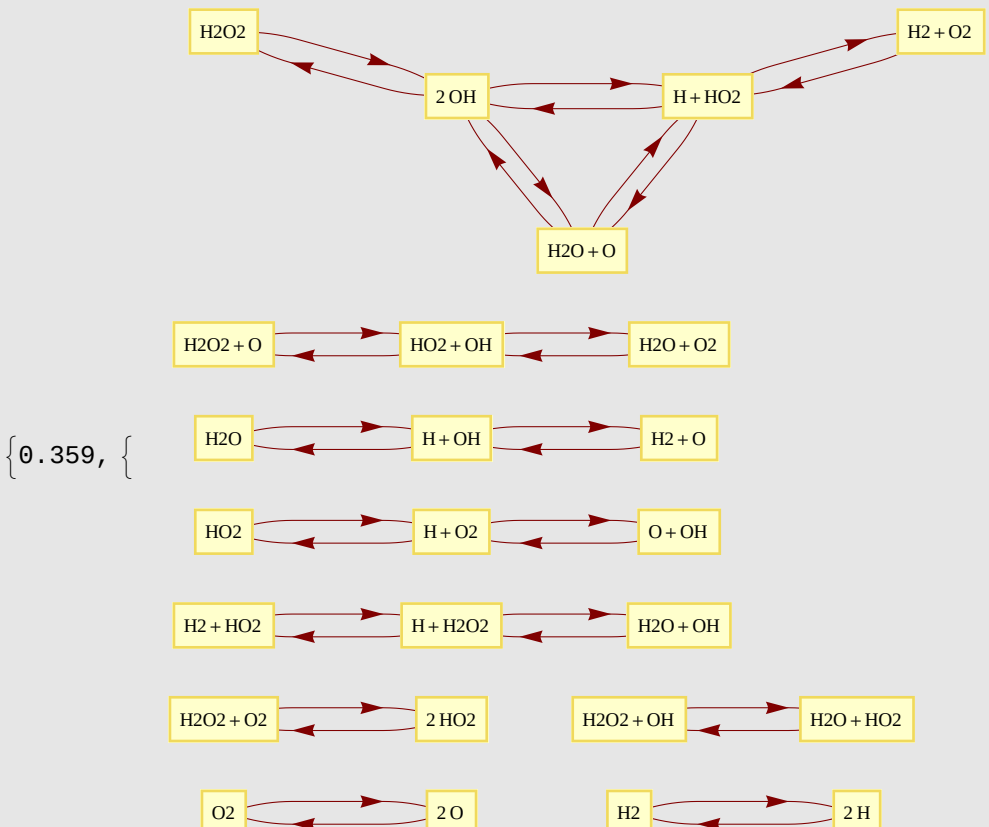
```
Ahmed2007
Burke2012
CRECK2012              H2O2 + O → HO2 + OH
Dagaut2003
Davis2005
GRI30
Hong2011
Keromnes2013
Konnov2008
Li2007
NUIG2010
OConaire2004
Rasmussen2008
SanDiego2011
SaxenaWilliams2006
Starik2009
Sun2007
USC2007
Zsely2005
```

```
hevery[[3, 2]] /. x_Equilibrium → Sequence[]
```

```
{H2O2 + O → HO2 + OH}
```

```
Row[{ShowFHJGraph[#[[2]], DirectedEdges → True,
       VertexLabeling → All, PlotLabel → #[[3]], ImageSize → 420], "   ",
      Column[Join[{"3rd body species deleted"}, #[[2]]]], "   ", Column[
       Join[{"Orig. Mechanism"}, #[[1]]]]} & /@ hevery[[indices]] // Timing
```

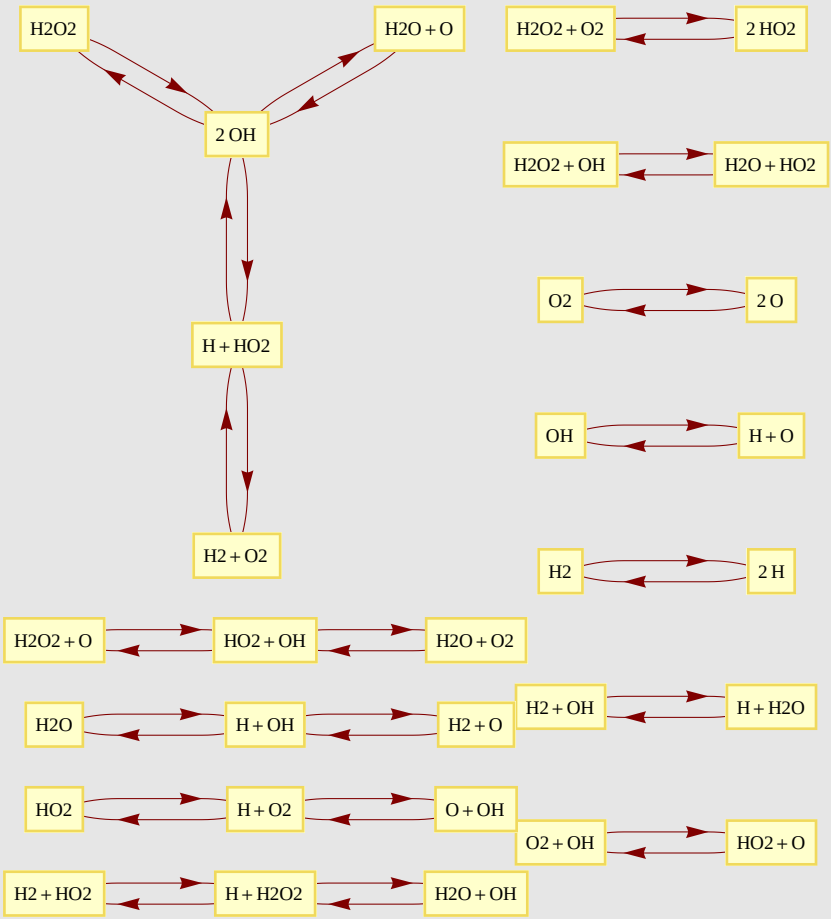
Ahmed2007



{0.359, {

3rd body species deleted	Orig. Mechanism
$2\,H \rightleftharpoons H2$	$H + O2 \rightleftharpoons O + OH$
$H2O \rightleftharpoons H + OH$	$H2 + O \rightleftharpoons H + OH$
$H + H2O \rightleftharpoons H2 + OH$	$H2 + OH \rightleftharpoons H + H2O$
$H2O2 \rightleftharpoons 2\,OH$	$2\,OH \rightleftharpoons H2O + O$
$H + H2O2 \rightleftharpoons H2 + HO2$	$H + O2 \rightleftharpoons HO2$
$H + H2O2 \rightleftharpoons H2O + OH$	$H + HO2 \rightleftharpoons 2\,OH$
$HO2 \rightleftharpoons H + O2$	$H + HO2 \rightleftharpoons H2 + O2$
$2\,HO2 \rightleftharpoons H2O2 + O2$	$H + HO2 \rightleftharpoons H2O + O$
$H + HO2 \rightleftharpoons H2O + O$	$HO2 + O \rightleftharpoons O2 + OH$
$H + HO2 \rightleftharpoons H2 + O2$	$HO2 + OH \rightleftharpoons H2O + O2$ ′
$H + HO2 \rightleftharpoons 2\,OH$	$2\,HO2 \rightleftharpoons H2O2 + O2$
$H2O + HO2 \rightleftharpoons H2O2 + OH$	$2\,OH \rightleftharpoons H2O2$
$2\,O \rightleftharpoons O2$	$H + H2O2 \rightleftharpoons H2 + HO2$
$H2 + O \rightleftharpoons H + OH$	$H + H2O2 \rightleftharpoons H2O + OH$
$H2O + O \rightleftharpoons 2\,OH$	$H2O2 + O \rightleftharpoons HO2 + OH$
$H2O2 + O \rightleftharpoons HO2 + OH$	$H2O2 + OH \rightleftharpoons H2O + HO2$
$HO2 + O \rightleftharpoons O2 + OH$	$2\,H \rightleftharpoons H2$
$H + O2 \rightleftharpoons O + OH$	$H + OH \rightleftharpoons H2O$
$H2O + O2 \rightleftharpoons HO2 + OH$	$2\,O \rightleftharpoons O2$

Burke2012


H2O2
H2O + O
2 OH
H + HO2
H2 + O2
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
H2 + OH
H + H2O
HO2
H + O2
O + OH
O2 + OH
HO2 + O
H2 + HO2
H + H2O2
H2O + OH

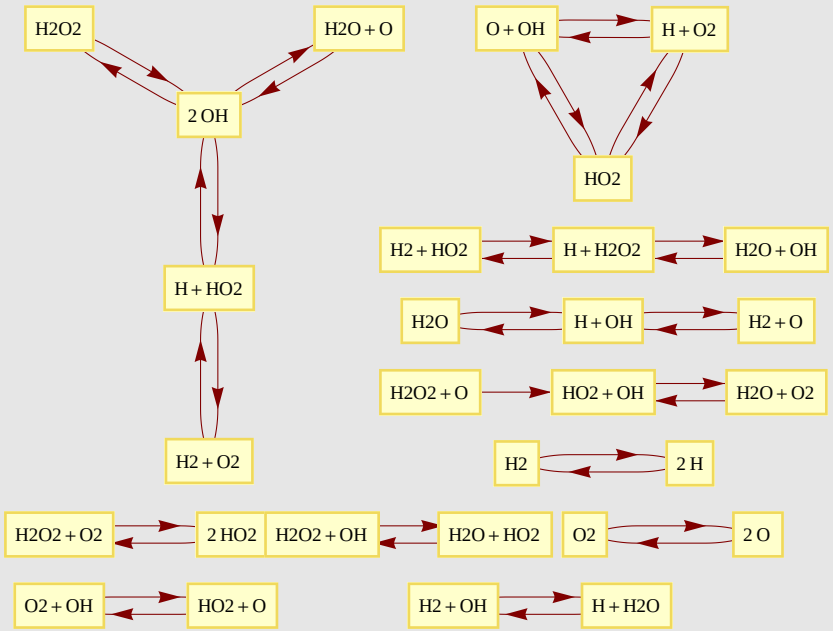
3rd body species deleted

2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O + O
H2 ⇌ 2 H
2 O ⇌ O2
H + O ⇌ OH
H2O ⇌ H + OH
2 H2O ⇌ H + H2O + OH
H + O2 ⇌ HO2 ,
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2 + HO2
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2

CRECK2012



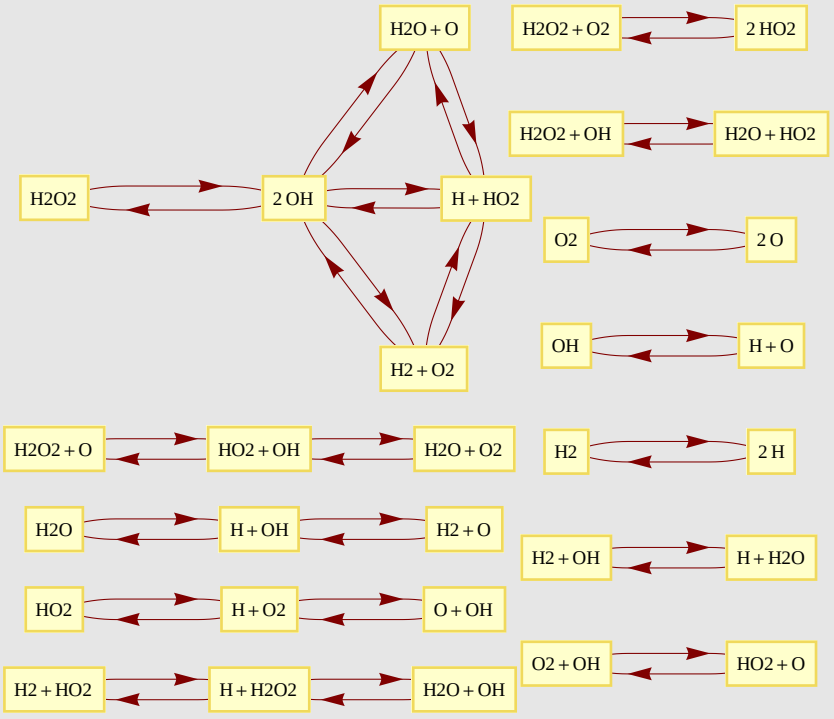
3rd body species deleted

$H_2O_2 + O \rightarrow HO_2 + OH$
$2\,H \rightleftharpoons H_2$
$H_2O \rightleftharpoons H + OH$
$H + H_2O \rightleftharpoons H_2 + OH$
$H_2O_2 \rightleftharpoons 2\,OH$
$H + H_2O_2 \rightleftharpoons H_2 + HO_2$
$H + H_2O_2 \rightleftharpoons H_2O + OH$
$HO_2 \rightleftharpoons H + O_2$
$HO_2 \rightleftharpoons O + OH$
$2\,HO_2 \rightleftharpoons H_2O_2 + O_2$
$H + HO_2 \rightleftharpoons H_2 + O_2$
$H + HO_2 \rightleftharpoons 2\,OH$
$H_2O + HO_2 \rightleftharpoons H_2O_2 + OH$
$2\,O \rightleftharpoons O_2$
$H_2 + O \rightleftharpoons H + OH$
$H_2O + O \rightleftharpoons 2\,OH$
$HO_2 + O \rightleftharpoons O_2 + OH$
$H + O_2 \rightleftharpoons O + OH$
$H_2O + O_2 \rightleftharpoons HO_2 + OH$

Orig. Mechanism

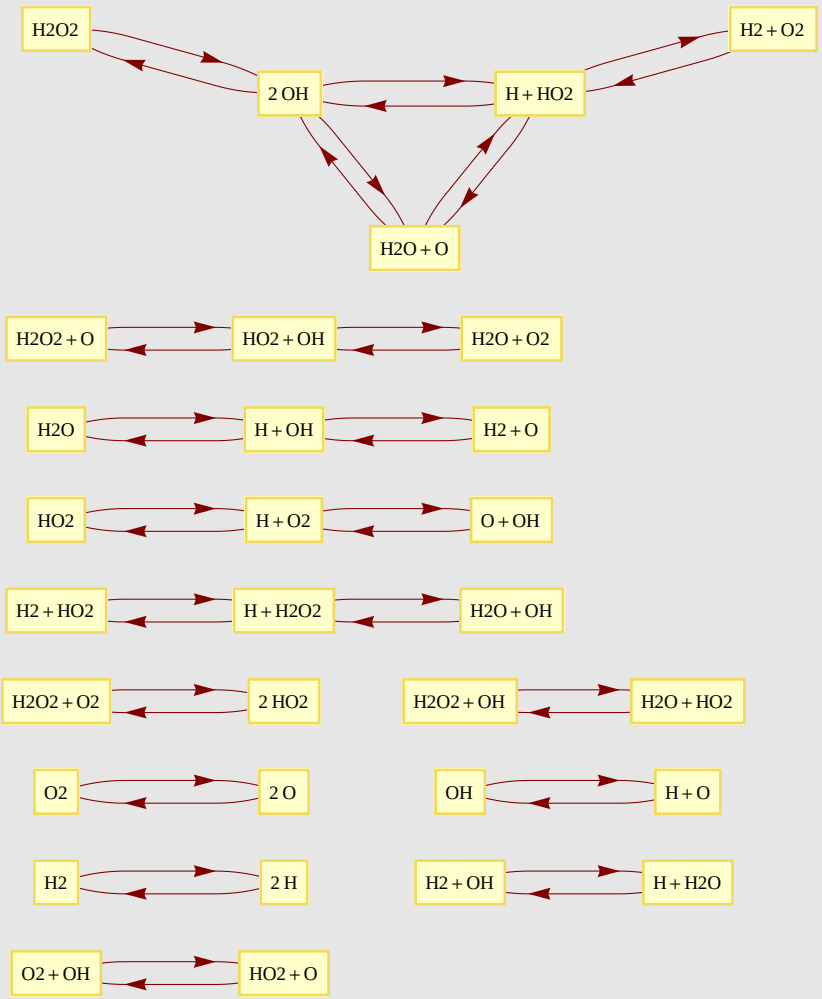
$H + O_2 \rightleftharpoons O + OH$
$H_2 + O \rightleftharpoons H + OH$
$H + O_2 \rightleftharpoons HO_2$
$H + 2\,O_2 \rightleftharpoons HO_2 + O_2$
$HO_2 + OH \rightleftharpoons H_2O + O_2$
$H + HO_2 \rightleftharpoons 2\,OH$
$HO_2 + O \rightleftharpoons O_2 + OH$
$2\,OH \rightleftharpoons H_2O + O$
$H_2 \rightleftharpoons 2\,H$
$O_2 \rightleftharpoons 2\,O$
$H + OH \rightleftharpoons H_2O$,
$H + HO_2 \rightleftharpoons H_2 + O_2$
$2\,HO_2 \rightleftharpoons H_2O_2 + O_2$
$2\,OH \rightleftharpoons H_2O_2$
$O + OH \rightleftharpoons HO_2$
$H + H_2O \rightleftharpoons H_2 + OH$
$H + H_2O_2 \rightleftharpoons H_2O + OH$
$H + H_2O_2 \rightleftharpoons H_2 + HO_2$
$H_2O + HO_2 \rightarrow H_2O_2 + OH$
$H_2O_2 + OH \rightarrow H_2O + HO_2$
$H_2O_2 + O \rightarrow HO_2 + OH$

Dagaut2003



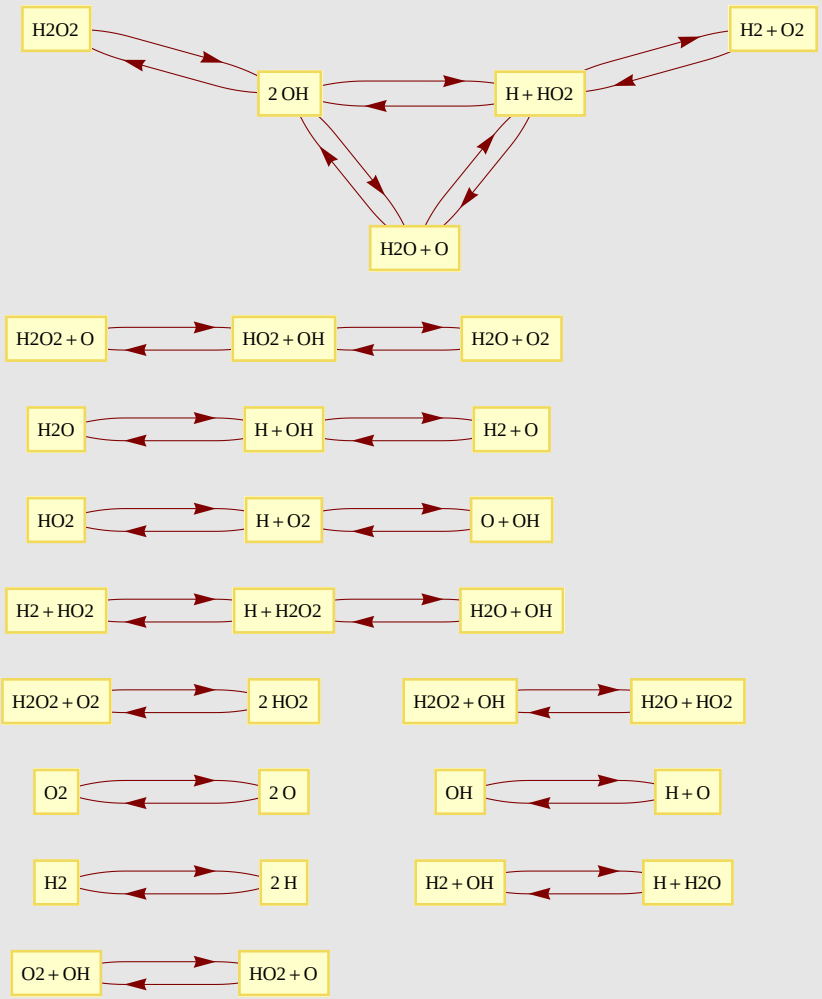
3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	2 H ⇌ H2
H2O ⇌ H + OH	2 O ⇌ O2
H + H2O ⇌ H2 + OH	H + O ⇌ OH
H2O2 ⇌ 2 OH	H2 + O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	H2 + O ⇌ H + OH
H + H2O2 ⇌ H2O + OH	H + O2 ⇌ O + OH
HO2 ⇌ H + O2	H + O2 ⇌ HO2
2 HO2 ⇌ H2O2 + O2	H + OH ⇌ H2O
H + HO2 ⇌ H2O + O	H2 + OH ⇌ H + H2O
H + HO2 ⇌ H2 + O2	H2O + O ⇌ 2 OH
H + HO2 ⇌ 2 OH	HO2 + OH ⇌ H2O + O2 ′
H2O + HO2 ⇌ H2O2 + OH	HO2 + O ⇌ O2 + OH
2 O ⇌ O2	H + HO2 ⇌ H2 + O2
H + O ⇌ OH	H + HO2 ⇌ 2 OH
H2 + O ⇌ H + OH	H + HO2 ⇌ H2O + O
H2O + O ⇌ 2 OH	2 HO2 ⇌ H2O2 + O2
H2O2 + O ⇌ HO2 + OH	2 OH ⇌ H2O2
HO2 + O ⇌ O2 + OH	H2O2 + OH ⇌ H2O + HO2
H + O2 ⇌ O + OH	H + H2O2 ⇌ H2 + HO2
H2 + O2 ⇌ 2 OH	H + H2O2 ⇌ H2O + OH
H2O + O2 ⇌ HO2 + OH	H2O2 + O ⇌ HO2 + OH

Davis2005


H2O2
2 OH
H + HO2
H2 + O2
H2O + O
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
HO2
H + O2
O + OH
H2 + HO2
H + H2O2
H2O + OH
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2 + OH
H + H2O
O2 + OH
HO2 + O

3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
H2O ⇌ H + OH	H2 + O ⇌ H + OH
H + H2O ⇌ H2 + OH	H2 + OH ⇌ H + H2O
H2O2 ⇌ 2 OH	2 OH ⇌ H2O + O
H + H2O2 ⇌ H2 + HO2	2 H ⇌ H2
H + H2O2 ⇌ H2O + OH	2 H + H2 ⇌ 2 H2
HO2 ⇌ H + O2	2 H + H2O ⇌ H2 + H2O
2 HO2 ⇌ H2O2 + O2	H + OH ⇌ H2O
H + HO2 ⇌ H2O + O	H + O ⇌ OH
H + HO2 ⇌ H2 + O2	2 O ⇌ O2
H + HO2 ⇌ 2 OH	H + O2 ⇌ HO2 ,
H2O + HO2 ⇌ H2O2 + OH	H2 + O2 ⇌ H + HO2
2 O ⇌ O2	2 OH ⇌ H2O2
H + O ⇌ OH	H + HO2 ⇌ H2O + O
H2 + O ⇌ H + OH	H + HO2 ⇌ 2 OH
H2O + O ⇌ 2 OH	HO2 + O ⇌ O2 + OH
H2O2 + O ⇌ HO2 + OH	HO2 + OH ⇌ H2O + O2
HO2 + O ⇌ O2 + OH	2 HO2 ⇌ H2O2 + O2
H + O2 ⇌ O + OH	H + H2O2 ⇌ H2 + HO2
H2O + O2 ⇌ HO2 + OH	H + H2O2 ⇌ H2O + OH
	H2O2 + O ⇌ HO2 + OH
	H2O2 + OH ⇌ H2O + HO2

GRI30


H2O2
2 OH
H + HO2
H2 + O2
H2O + O
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
HO2
H + O2
O + OH
H2 + HO2
H + H2O2
H2O + OH
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2 + OH
H + H2O
O2 + OH
HO2 + O

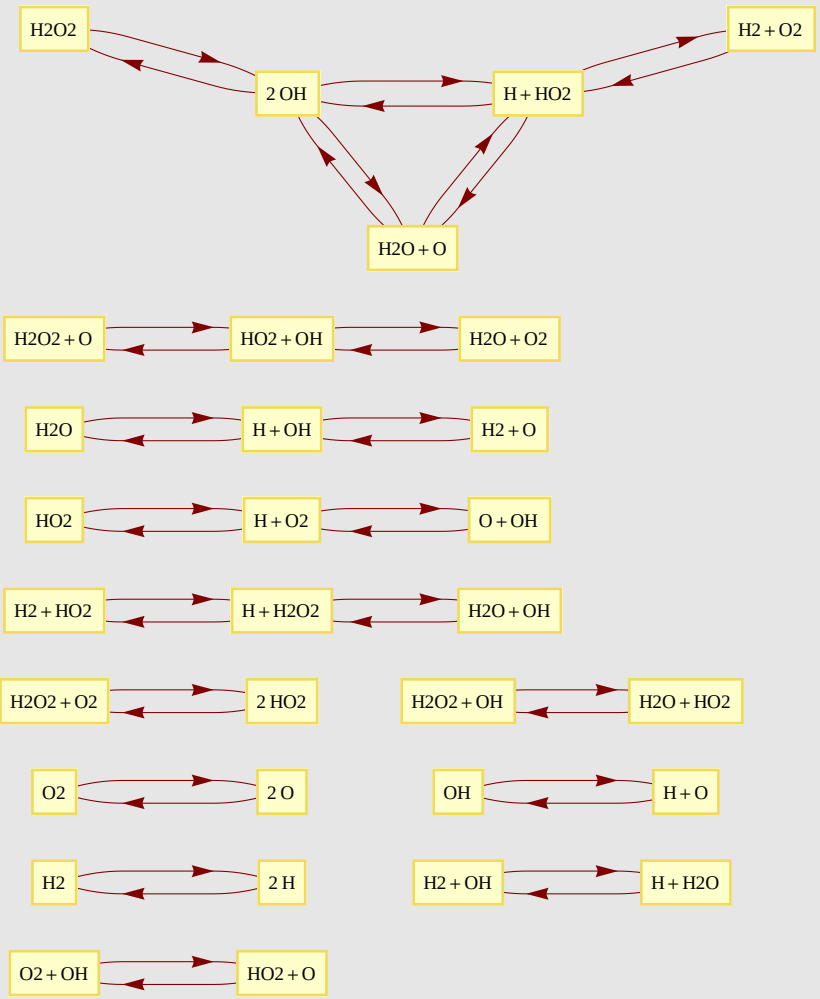
3rd body species deleted

2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
HO2 + O ⇌ O2 + OH
H2O2 + O ⇌ HO2 + OH
H + O2 ⇌ HO2
H + 2 O2 ⇌ HO2 + O2
H + H2O + O2 ⇌ H2O + HO2
H + N2 + O2 ⇌ HO2 + N2
H + O2 ⇌ O + OH
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
2 H + H2O ⇌ H2 + H2O ’
H + OH ⇌ H2O
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O2
2 OH ⇌ H2O + O
HO2 + OH ⇌ H2O + O2
H2O2 + OH ⇌ H2O + HO2
2 HO2 ⇌ H2O2 + O2

Hong2011


H2O2
2 OH
H + HO2
H2 + O2
H2O + O
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
HO2
H + O2
O + OH
H2 + HO2
H + H2O2
H2O + OH
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2 + OH
H + H2O
O2 + OH
HO2 + O

3rd body species deleted

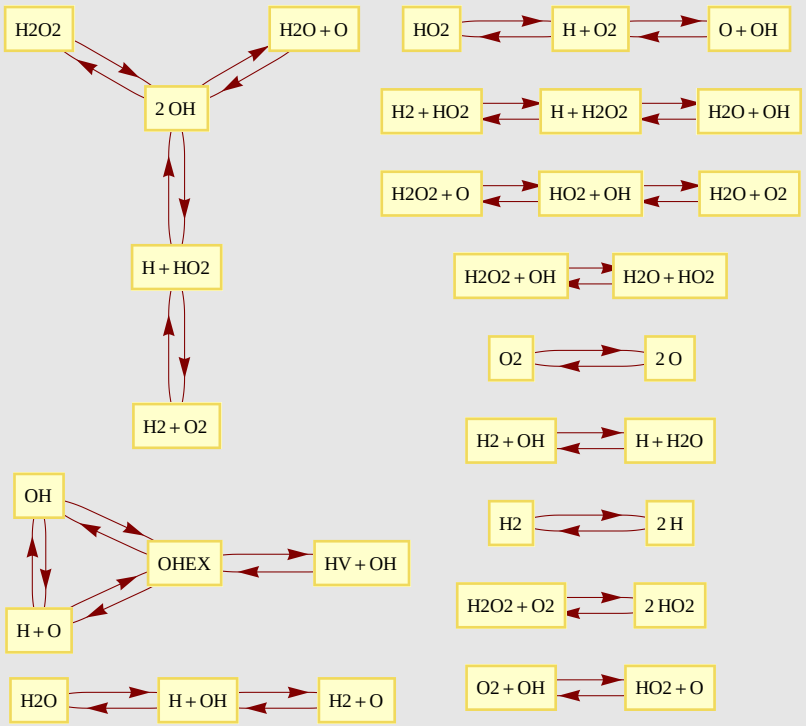
2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

H + O2 ⇌ O + OH
H + O2 ⇌ HO2
H2O2 ⇌ 2 OH
H2O2 + OH ⇌ H2O + HO2
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O ⇌ H + OH
2 H2O ⇌ H + H2O + OH
2 OH ⇌ H2O + O
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
H + HO2 ⇌ 2 OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
HO2 + O ⇌ O2 + OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2 ⇌ 2 H
2 H2 ⇌ 2 H + H2
H2 + N2 ⇌ 2 H + N2
H2 + O2 ⇌ 2 H + O2
2 O ⇌ O2
H + O ⇌ OH

,

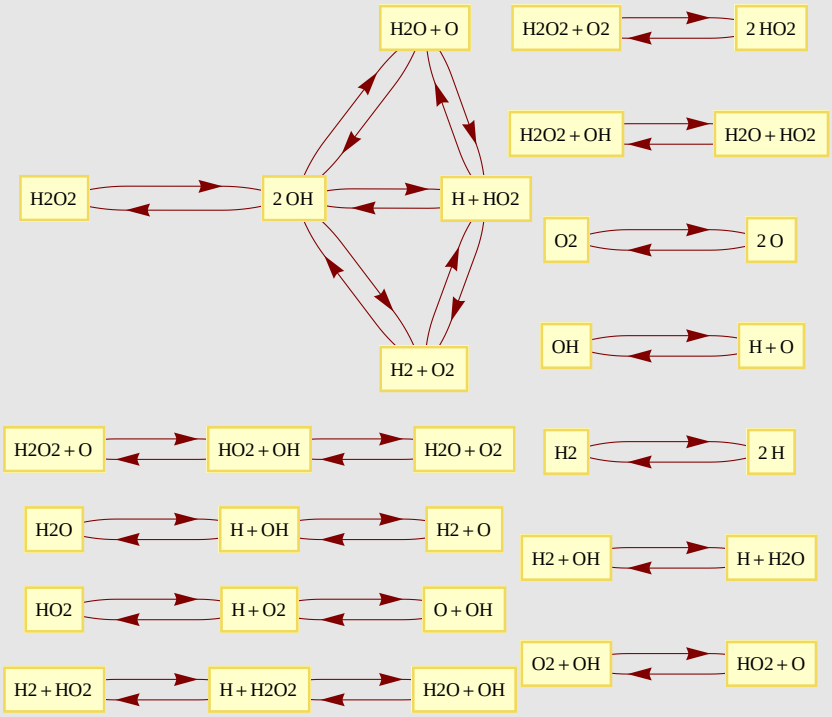
Keromnes2013



```
3rd body species deleted
2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H + O ⇌ OHEX
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH
OH ⇌ OHEX
HV + OH ⇌ OHEX
```

```
Orig. Mechanism
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
H2O + O ⇌ 2 OH
H2 ⇌ 2 H
2 O ⇌ O2
H + O ⇌ OH
H + OH ⇌ H2O
H + O2 ⇌ HO2
H + HO2 ⇌ 2 OH
H2 + O2 ⇌ H + HO2
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2     ,
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2 + HO2
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
H + O ⇌ OHEX
H2O + OHEX ⇌ H2O + OH
H2 + OHEX ⇌ H2 + OH
N2 + OHEX ⇌ N2 + OH
OH + OHEX ⇌ 2 OH
H + OHEX ⇌ H + OH
OHEX ⇌ OH
OHEX ⇌ HV + OH
O2 + OHEX ⇌ O2 + OH
```

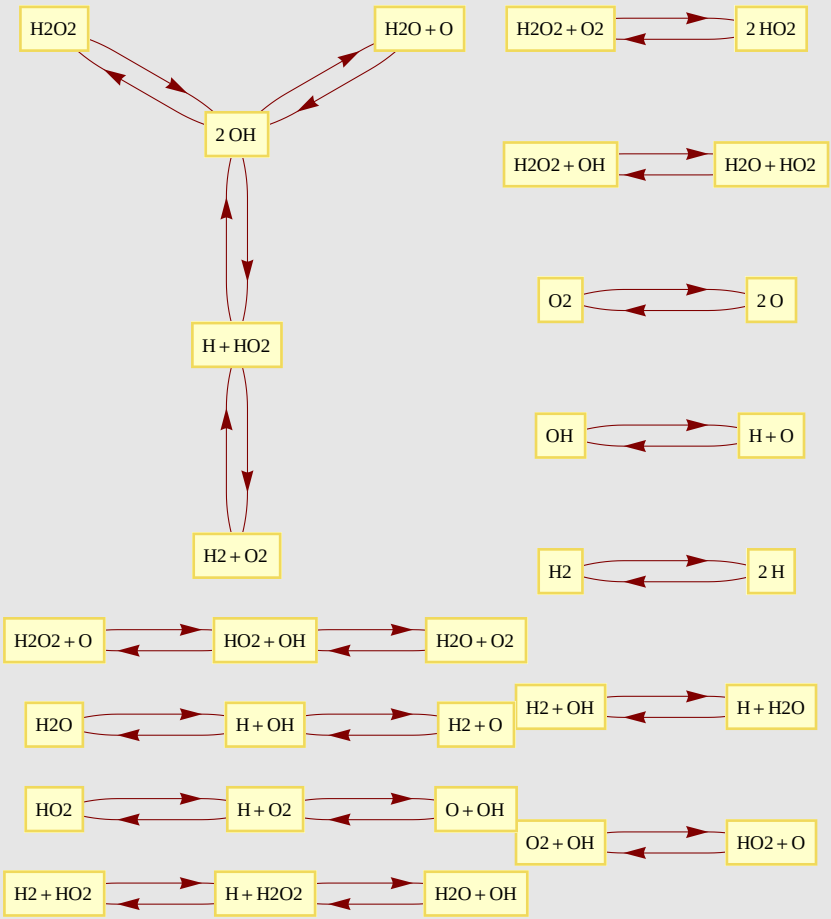
Konnov2008




```
3rd body species deleted
2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2 + O2 ⇌ 2 OH
H2O + O2 ⇌ HO2 + OH
```

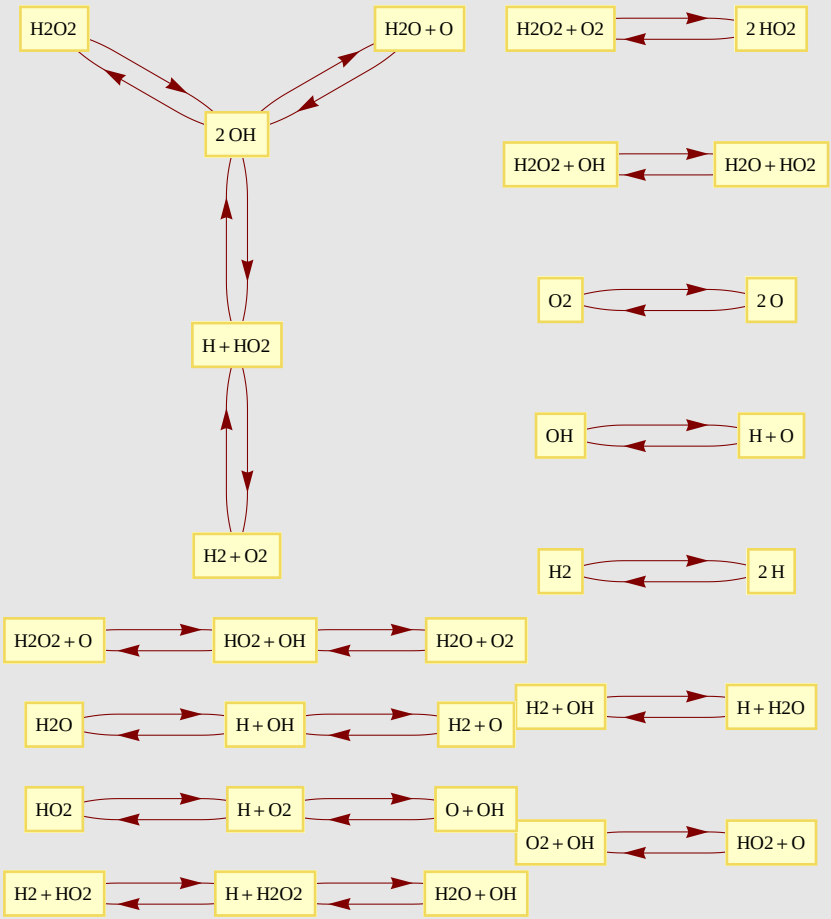
```
Orig. Mechanism
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
2 H + N2 ⇌ H2 + N2
3 H ⇌ H + H2
2 O ⇌ O2
H + O ⇌ OH
H2O ⇌ H + OH
2 H2O ⇌ H + H2O + OH
H + O2 ⇌ HO2
2 OH ⇌ H2O2
H2 + O ⇌ H + OH
H + O2 ⇌ O + OH
H2 + OH ⇌ H + H2O      '
2 OH ⇌ H2O + O
HO2 + O ⇌ O2 + OH
H + HO2 ⇌ 2 OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H2 + O2 ⇌ 2 OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
```

Li2007


H2O2
H2O + O
2 OH
H + HO2
H2 + O2
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
H2 + OH
H + H2O
HO2
H + O2
O + OH
O2 + OH
HO2 + O
H2 + HO2
H + H2O2
H2O + OH

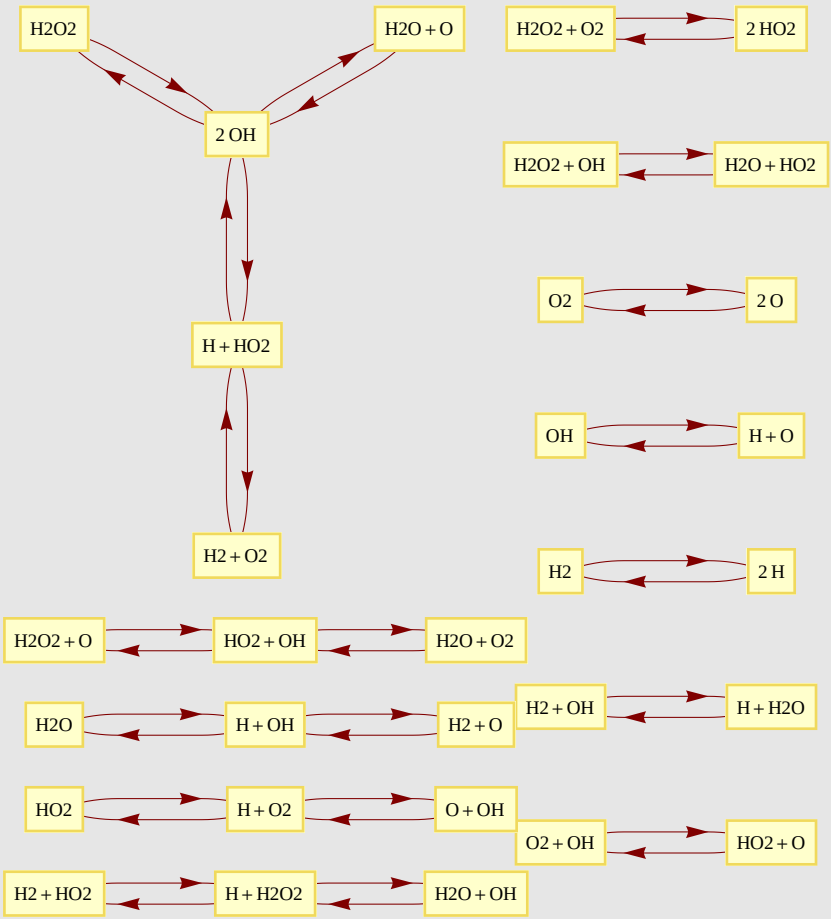
3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
H2O ⇌ H + OH	H2 + O ⇌ H + OH
H + H2O ⇌ H2 + OH	H2 + OH ⇌ H + H2O
H2O2 ⇌ 2 OH	H2O + O ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	H2 ⇌ 2 H
H + H2O2 ⇌ H2O + OH	2 O ⇌ O2
HO2 ⇌ H + O2	H + O ⇌ OH
2 HO2 ⇌ H2O2 + O2	H + OH ⇌ H2O
H + HO2 ⇌ H2 + O2	H + O2 ⇌ HO2
H + HO2 ⇌ 2 OH	H + HO2 ⇌ H2 + O2 ’
H2O + HO2 ⇌ H2O2 + OH	H + HO2 ⇌ 2 OH
2 O ⇌ O2	HO2 + O ⇌ O2 + OH
H + O ⇌ OH	HO2 + OH ⇌ H2O + O2
H2 + O ⇌ H + OH	2 HO2 ⇌ H2O2 + O2
H2O + O ⇌ 2 OH	H2O2 ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH	H + H2O2 ⇌ H2O + OH
HO2 + O ⇌ O2 + OH	H + H2O2 ⇌ H2 + HO2
H + O2 ⇌ O + OH	H2O2 + O ⇌ HO2 + OH
H2O + O2 ⇌ HO2 + OH	H2O2 + OH ⇌ H2O + HO2

NUIG2010


H2O2
H2O + O
2 OH
H + HO2
H2 + O2
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
H2 + OH
H + H2O
HO2
H + O2
O + OH
O2 + OH
HO2 + O
H2 + HO2
H + H2O2
H2O + OH

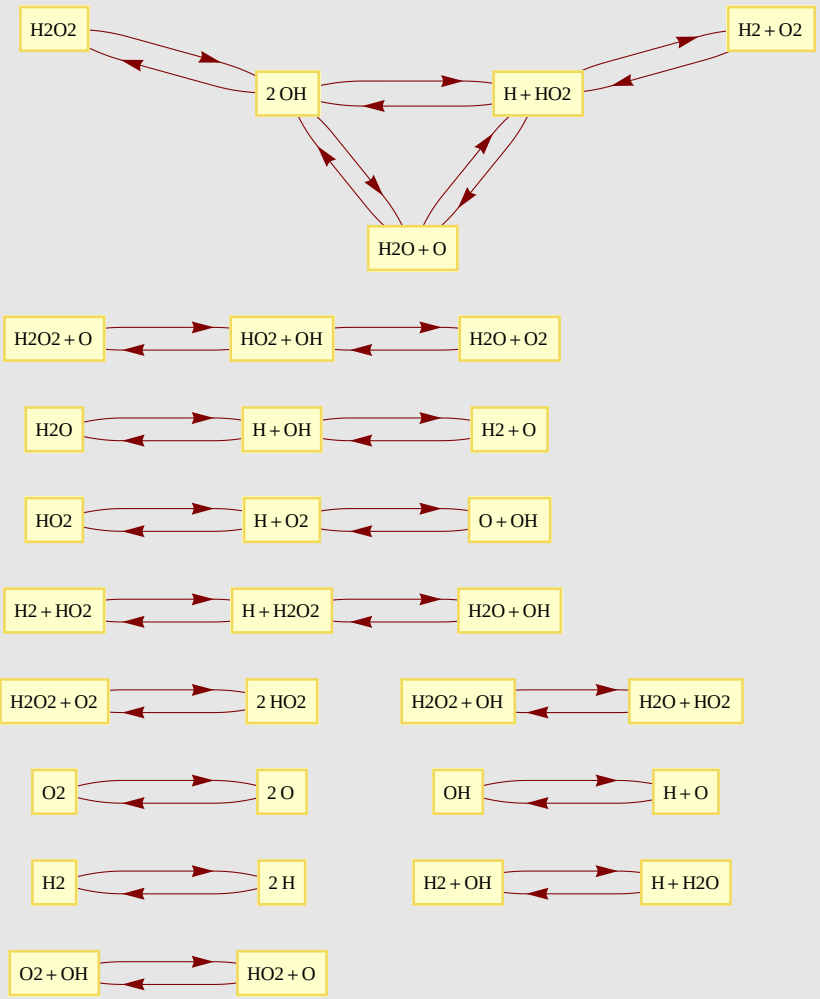
3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
H2O ⇌ H + OH	H2 + O ⇌ H + OH
H + H2O ⇌ H2 + OH	H2 + OH ⇌ H + H2O
H2O2 ⇌ 2 OH	H2O + O ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	H2 ⇌ 2 H
H + H2O2 ⇌ H2O + OH	O2 ⇌ 2 O
HO2 ⇌ H + O2	OH ⇌ H + O
2 HO2 ⇌ H2O2 + O2	H2O ⇌ H + OH
H + HO2 ⇌ H2 + O2	H + O2 ⇌ HO2
H + HO2 ⇌ 2 OH	H + HO2 ⇌ H2 + O2 ’
H2O + HO2 ⇌ H2O2 + OH	H + HO2 ⇌ 2 OH
2 O ⇌ O2	HO2 + O ⇌ O2 + OH
H + O ⇌ OH	HO2 + OH ⇌ H2O + O2
H2 + O ⇌ H + OH	H2O2 + O2 ⇌ 2 HO2
H2O + O ⇌ 2 OH	H2O2 ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH	H + H2O2 ⇌ H2O + OH
HO2 + O ⇌ O2 + OH	H + H2O2 ⇌ H2 + HO2
H + O2 ⇌ O + OH	H2O2 + O ⇌ HO2 + OH
H2O + O2 ⇌ HO2 + OH	H2O2 + OH ⇌ H2O + HO2

OConaire2004



3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
H2O ⇌ H + OH	H2 + O ⇌ H + OH
H + H2O ⇌ H2 + OH	H2 + OH ⇌ H + H2O
H2O2 ⇌ 2 OH	H2O + O ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	H2 ⇌ 2 H
H + H2O2 ⇌ H2O + OH	O2 ⇌ 2 O
HO2 ⇌ H + O2	OH ⇌ H + O
2 HO2 ⇌ H2O2 + O2	H2O ⇌ H + OH
H + HO2 ⇌ H2 + O2	H + O2 ⇌ HO2
H + HO2 ⇌ 2 OH	H + HO2 ⇌ H2 + O2 ’
H2O + HO2 ⇌ H2O2 + OH	H + HO2 ⇌ 2 OH
2 O ⇌ O2	HO2 + O ⇌ O2 + OH
H + O ⇌ OH	HO2 + OH ⇌ H2O + O2
H2 + O ⇌ H + OH	H2O2 + O2 ⇌ 2 HO2
H2O + O ⇌ 2 OH	H2O2 ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH	H + H2O2 ⇌ H2O + OH
HO2 + O ⇌ O2 + OH	H + H2O2 ⇌ H2 + HO2
H + O2 ⇌ O + OH	H2O2 + O ⇌ HO2 + OH
H2O + O2 ⇌ HO2 + OH	H2O2 + OH ⇌ H2O + HO2

Rasmussen2008



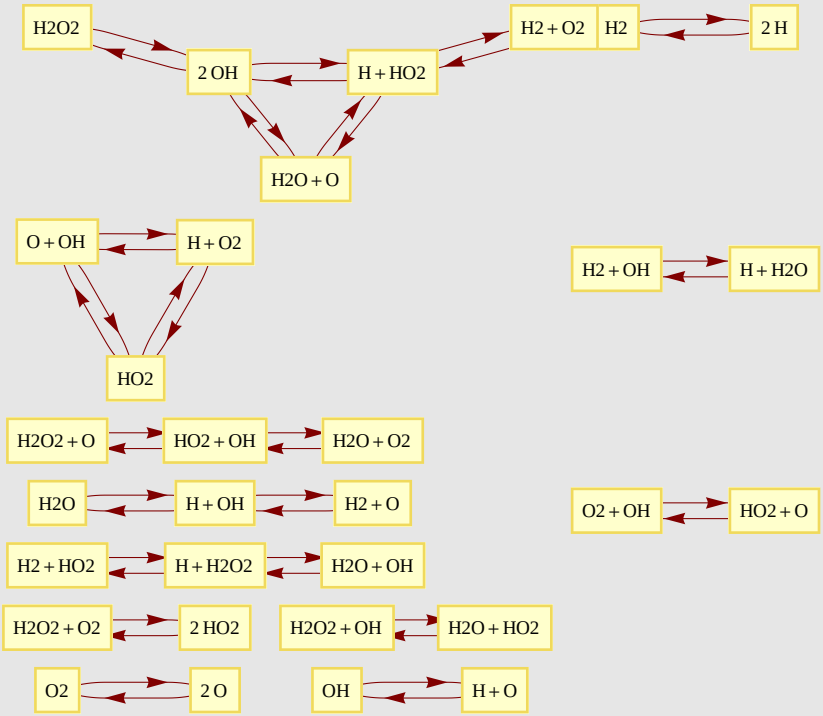
3rd body species deleted

2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

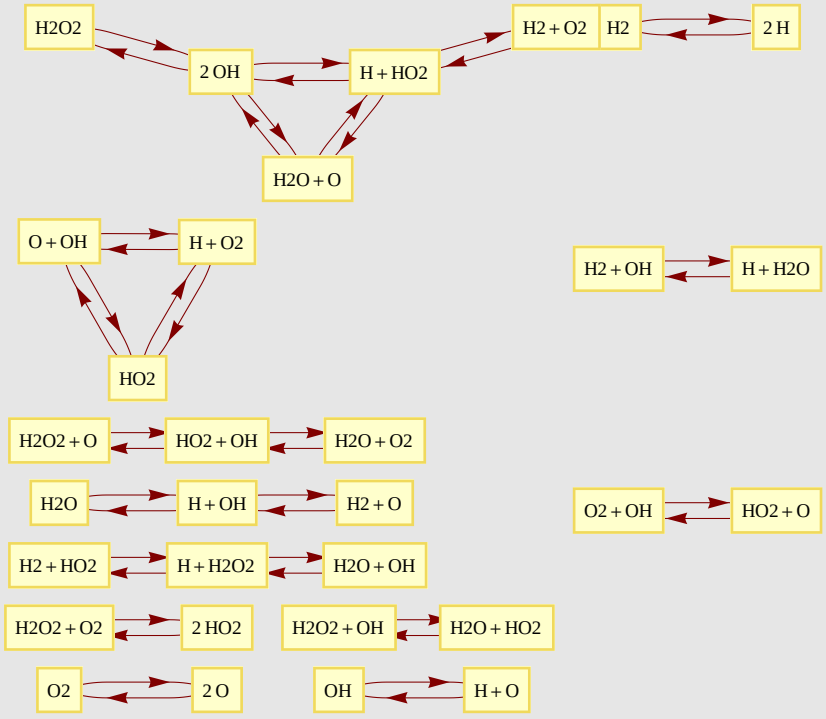
H + O2 ⇌ O + OH
2 H ⇌ H2
2 H + N2 ⇌ H2 + N2
2 H + H2 ⇌ 2 H2
2 H + H2O ⇌ H2 + H2O
H + O ⇌ OH
H + O2 ⇌ HO2
2 O ⇌ O2
H2 + O ⇌ H + OH
2 OH ⇌ H2O + O
H + OH ⇌ H2O
H2 + OH ⇌ H + H2O
H2 + O2 ⇌ H + HO2
H + HO2 ⇌ 2 OH
H + HO2 ⇌ H2O + O
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2 + HO2
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2

SanDiego2011



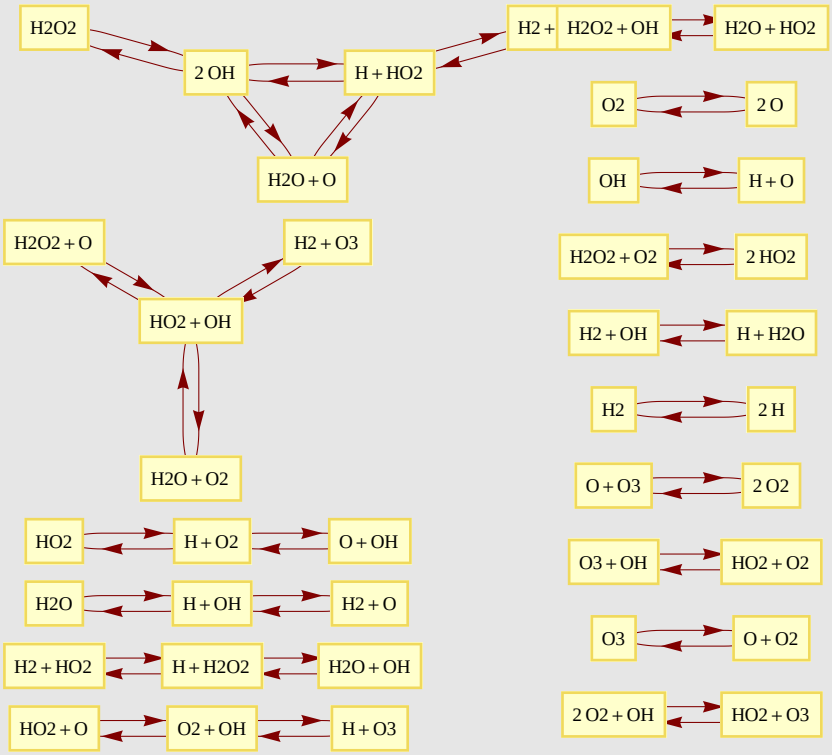
3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
H2O ⇌ H + OH	H2 + O ⇌ H + OH
H + H2O ⇌ H2 + OH	H2 + OH ⇌ H + H2O
H2O2 ⇌ 2 OH	H2O + O ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	2 H ⇌ H2
H + H2O2 ⇌ H2O + OH	H + OH ⇌ H2O
HO2 ⇌ H + O2	2 O ⇌ O2
HO2 ⇌ O + OH	H + O ⇌ OH
2 HO2 ⇌ H2O2 + O2	O + OH ⇌ HO2
H + HO2 ⇌ H2O + O	H + O2 ⇌ HO2
H + HO2 ⇌ H2 + O2	H + HO2 ⇌ 2 OH
H + HO2 ⇌ 2 OH	H + HO2 ⇌ H2 + O2
H2O + HO2 ⇌ H2O2 + OH	H + HO2 ⇌ H2O + O
2 O ⇌ O2	HO2 + O ⇌ O2 + OH
H + O ⇌ OH	HO2 + OH ⇌ H2O + O2
H2 + O ⇌ H + OH	2 OH ⇌ H2O2
H2O + O ⇌ 2 OH	2 HO2 ⇌ H2O2 + O2
H2O2 + O ⇌ HO2 + OH	H + H2O2 ⇌ H2 + HO2
HO2 + O ⇌ O2 + OH	H + H2O2 ⇌ H2O + OH
H + O2 ⇌ O + OH	H2O2 + OH ⇌ H2O + HO2
H2O + O2 ⇌ HO2 + OH	H2O2 + O ⇌ HO2 + OH

SaxenaWilliams2006



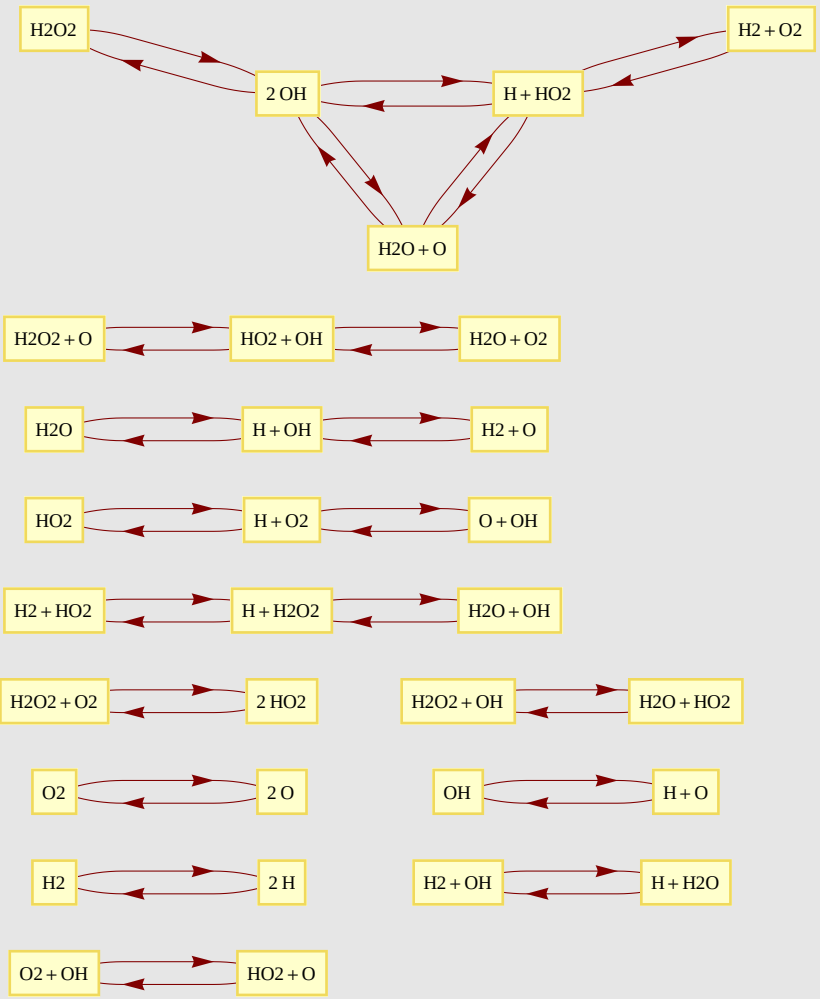
3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
H2O ⇌ H + OH	H2 + O ⇌ H + OH
H + H2O ⇌ H2 + OH	H2 + OH ⇌ H + H2O
H2O2 ⇌ 2 OH	H2O + O ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	2 H ⇌ H2
H + H2O2 ⇌ H2O + OH	H + OH ⇌ H2O
HO2 ⇌ H + O2	2 O ⇌ O2
HO2 ⇌ O + OH	H + O ⇌ OH
2 HO2 ⇌ H2O2 + O2	O + OH ⇌ HO2
H + HO2 ⇌ H2O + O	H + O2 ⇌ HO2
H + HO2 ⇌ H2 + O2	H + HO2 ⇌ 2 OH
H + HO2 ⇌ 2 OH	H + HO2 ⇌ H2 + O2
H2O + HO2 ⇌ H2O2 + OH	H + HO2 ⇌ H2O + O
2 O ⇌ O2	HO2 + O ⇌ O2 + OH
H + O ⇌ OH	HO2 + OH ⇌ H2O + O2
H2 + O ⇌ H + OH	2 OH ⇌ H2O2
H2O + O ⇌ 2 OH	2 HO2 ⇌ H2O2 + O2
H2O2 + O ⇌ HO2 + OH	H + H2O2 ⇌ H2 + HO2
HO2 + O ⇌ O2 + OH	H + H2O2 ⇌ H2O + OH
H + O2 ⇌ O + OH	H2O2 + OH ⇌ H2O + HO2
H2O + O2 ⇌ HO2 + OH	H2O2 + O ⇌ HO2 + OH

Starik2009



3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + H2O ⇌ H2 + OH
H2O ⇌ H + OH	H + O2 ⇌ O + OH
H + H2O ⇌ H2 + OH	H2 + O ⇌ H + OH
H2O2 ⇌ 2 OH	O2 ⇌ 2 O
H + H2O2 ⇌ H2 + HO2	H2 ⇌ 2 H
H + H2O2 ⇌ H2O + OH	H2O ⇌ H + OH
HO2 ⇌ H + O2	OH ⇌ H + O
2 HO2 ⇌ H2O2 + O2	H2O + O ⇌ 2 OH
H + HO2 ⇌ H2O + O	H + O2 ⇌ HO2
H + HO2 ⇌ H2 + O2	H2 + O2 ⇌ H + HO2
H + HO2 ⇌ 2 OH	H2O + O ⇌ H + HO2
H2O + HO2 ⇌ H2O2 + OH	H2O + O2 ⇌ HO2 + OH
2 O ⇌ O2	2 OH ⇌ H + HO2 ,
H + O ⇌ OH	O2 + OH ⇌ HO2 + O
H2 + O ⇌ H + OH	H + H2O2 ⇌ H2 + HO2
H2O + O ⇌ 2 OH	H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH	2 HO2 ⇌ H2O2 + O2
HO2 + O ⇌ O2 + OH	H2O + HO2 ⇌ H2O2 + OH
2 O2 ⇌ O + O3	HO2 + OH ⇌ H2O2 + O
H + O2 ⇌ O + OH	H2O2 ⇌ 2 OH
H2O + O2 ⇌ HO2 + OH	O3 ⇌ O + O2
HO2 + O2 ⇌ O3 + OH	H + O3 ⇌ O2 + OH
O + O2 ⇌ O3	O + O3 ⇌ 2 O2
H + O3 ⇌ O2 + OH	O3 + OH ⇌ HO2 + O2
H2 + O3 ⇌ HO2 + OH	H2 + O3 ⇌ HO2 + OH
HO2 + O3 ⇌ 2 O2 + OH	HO2 + O3 ⇌ 2 O2 + OH

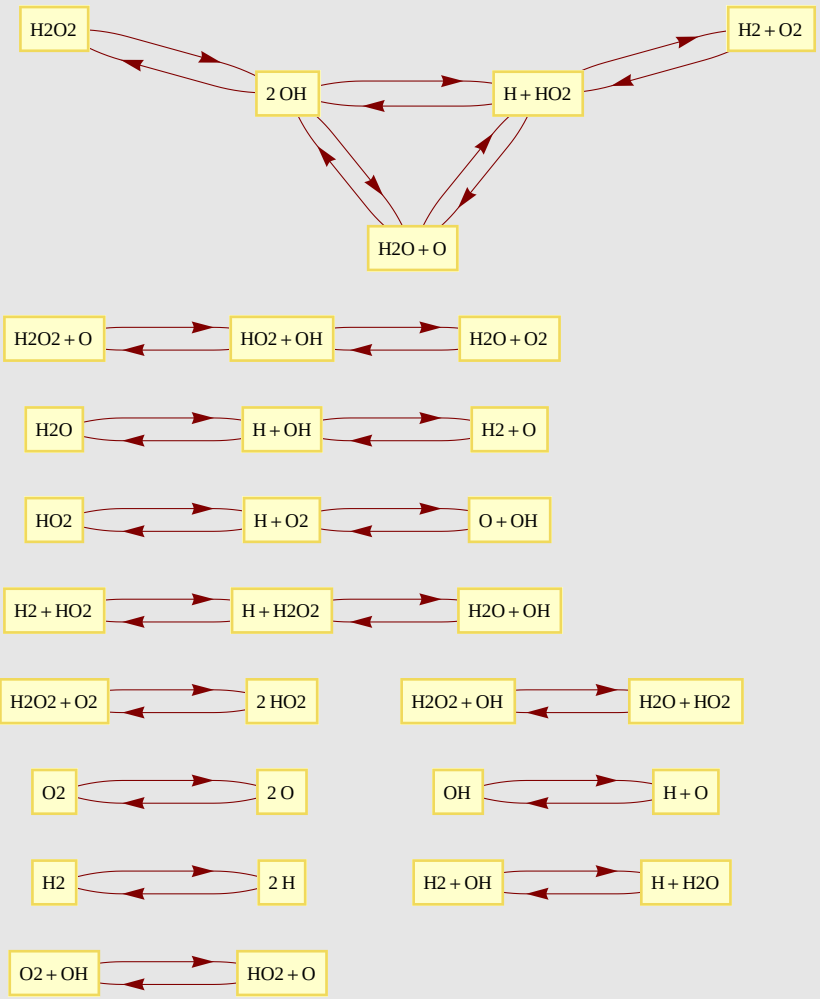
Sun2007


H2O2
2 OH
H + HO2
H2 + O2
H2O + O
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
HO2
H + O2
O + OH
H2 + HO2
H + H2O2
H2O + OH
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2 + OH
H + H2O
O2 + OH
HO2 + O

```
3rd body species deleted
2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH
```

```
Orig. Mechanism
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O + O
H2 + O2 ⇌ H + HO2
H2 ⇌ 2 H
2 H2 ⇌ 2 H + H2
H2 + N2 ⇌ 2 H + N2
H2 + H2O ⇌ 2 H + H2O
2 O ⇌ O2
H + O ⇌ OH
H + OH ⇌ H2O                ,
H + O2 ⇌ HO2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
```

USC2007


H2O2
2 OH
H + HO2
H2 + O2
H2O + O
H2O2 + O
HO2 + OH
H2O + O2
H2O
H + OH
H2 + O
HO2
H + O2
O + OH
H2 + HO2
H + H2O2
H2O + OH
H2O2 + O2
2 HO2
H2O2 + OH
H2O + HO2
O2
2 O
OH
H + O
H2
2 H
H2 + OH
H + H2O
O2 + OH
HO2 + O

3rd body species deleted

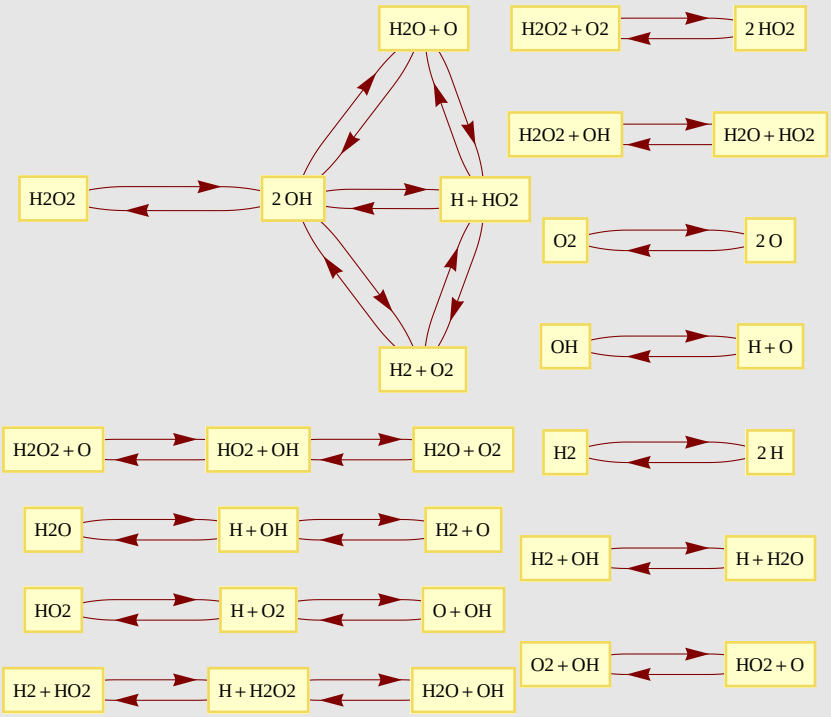
2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O + O
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
2 H + H2O ⇌ H2 + H2O
H + OH ⇌ H2O
H + O ⇌ OH
2 O ⇌ O2
H + O2 ⇌ HO2
H2 + O2 ⇌ H + HO2
2 OH ⇌ H2O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH
2 HO2 ⇌ H2O2 + O2
HO2 + OH ⇌ H2O + O2
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2

,

Zsely2005



3rd body species deleted

2 H ⇌ H2
H2O ⇌ H + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2 + O2 ⇌ 2 OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

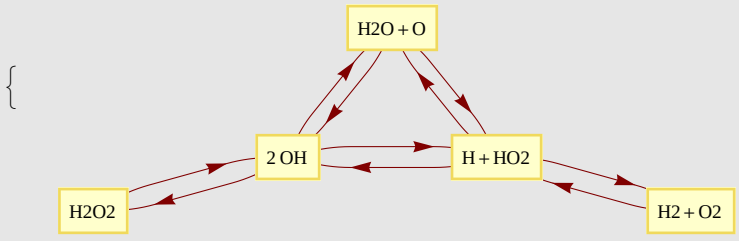
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
H + O2 ⇌ HO2
H + O2 ⇌ O + OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
2 OH ⇌ H2O2
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
H + O ⇌ OH
H + OH ⇌ H2O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H + HO2 ⇌ H2O + O
2 O ⇌ O2
HO2 + O ⇌ O2 + OH
2 OH ⇌ H2O + O
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2 + O2 ⇌ 2 OH

```
maxfhjcomponents = MaxFHJWeaklyConnectedComponents[hevery[[#, 2]] & /@ indices;
```

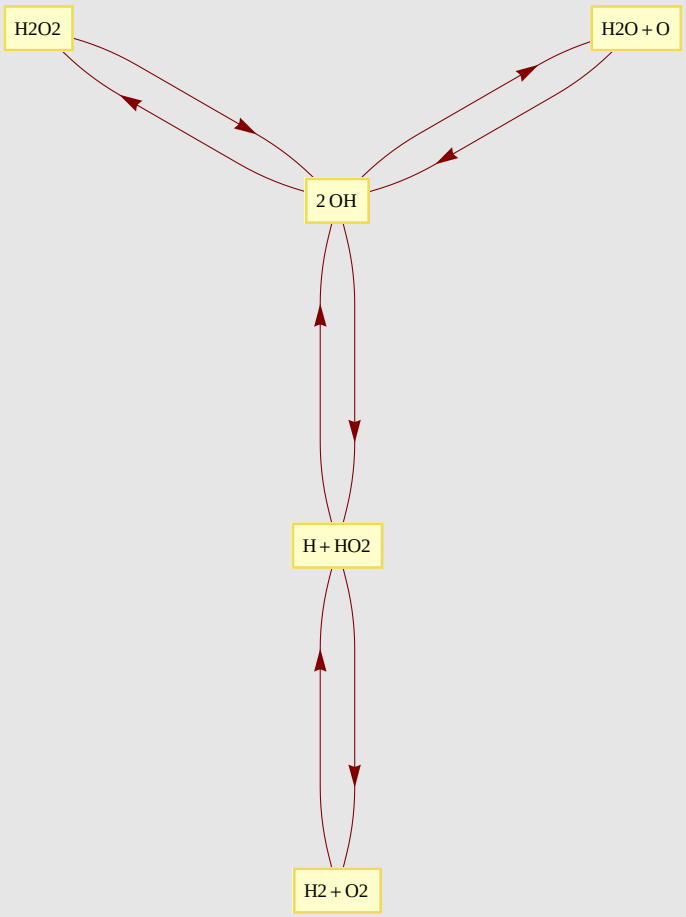
```
maxfhjedges = Flatten[(First /@ #) & /@ maxfhjcomponents, 1];
```

```
GraphPlot[First[#], VertexLabeling → True, DirectedEdges → True,
   ImageSize → 350, PlotLabel → "Max weakly connected component of mech " <>
     ToString[hevery[[Last[#], 3]] <> "\n"] & /@
 Transpose[{maxfhjedges, indices}]
```

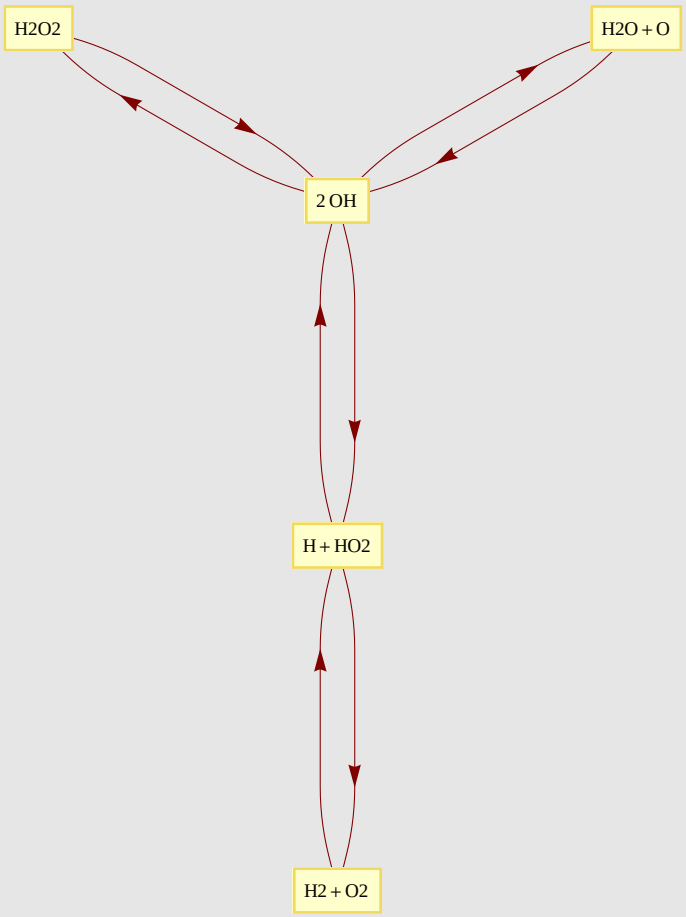
Max weakly connected component of mech Ahmed2007



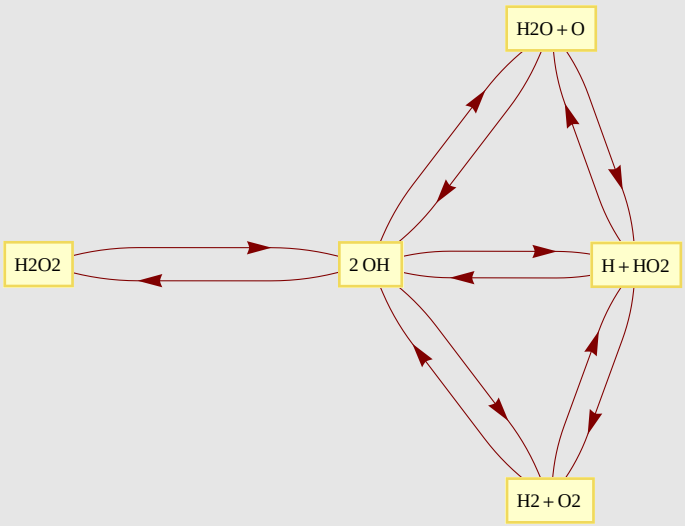
Max weakly connected component of mech Burke2012



Max weakly connected component of mech CRECK2012

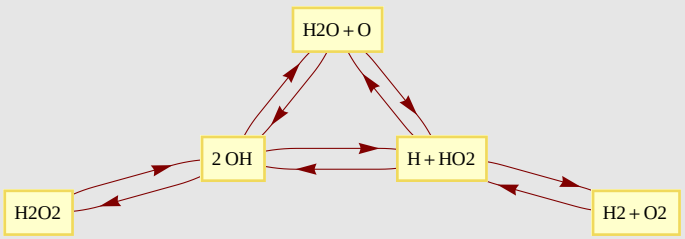


Max weakly connected component of mech Dagaut2003



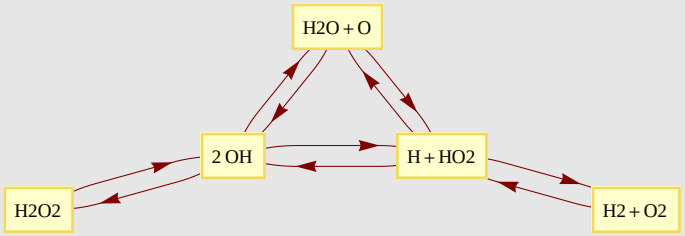
,

Max weakly connected component of mech Davis2005



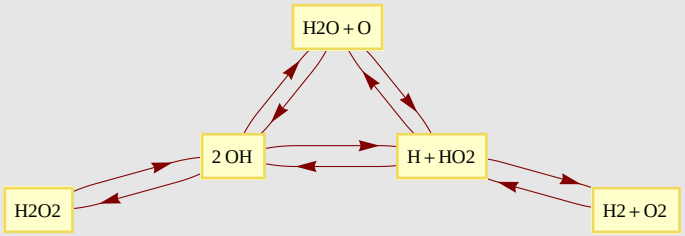
,

Max weakly connected component of mech GRI30



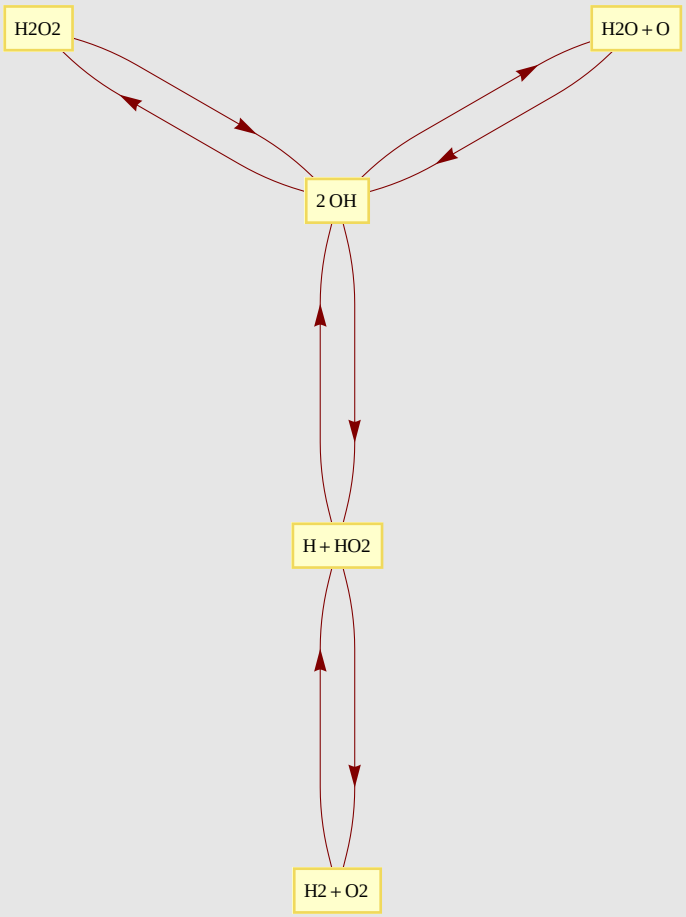
,

Max weakly connected component of mech Hong2011

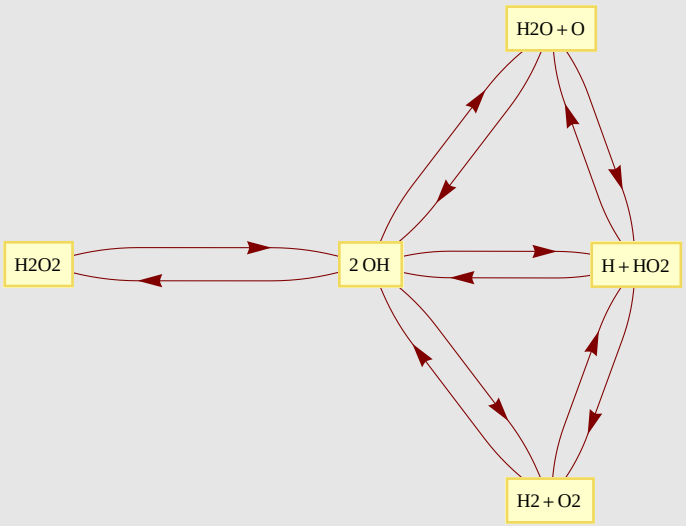


,

Max weakly connected component of mech Keromnes2013

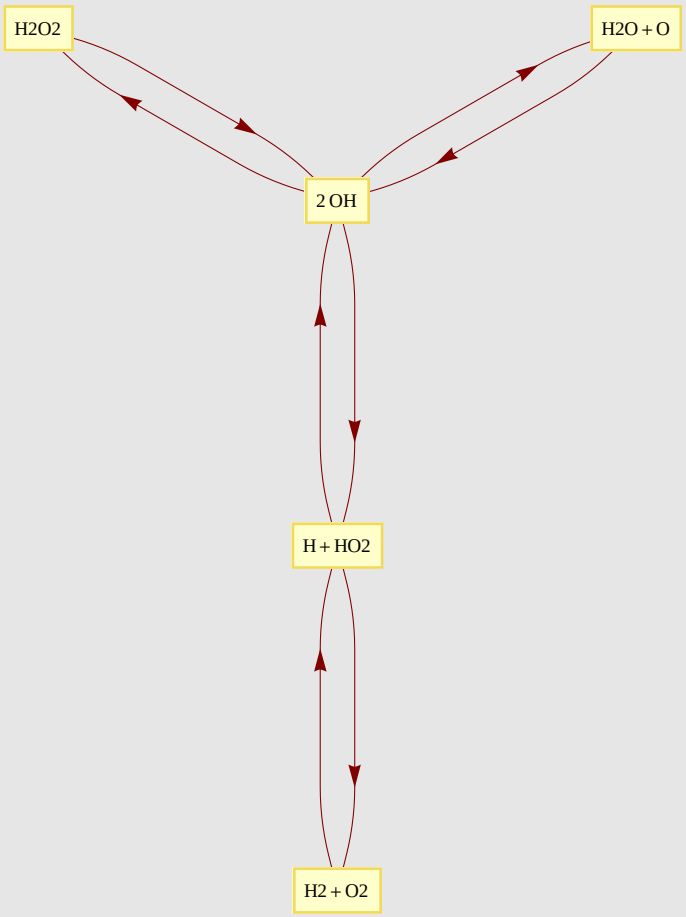


Max weakly connected component of mech Konnov2008

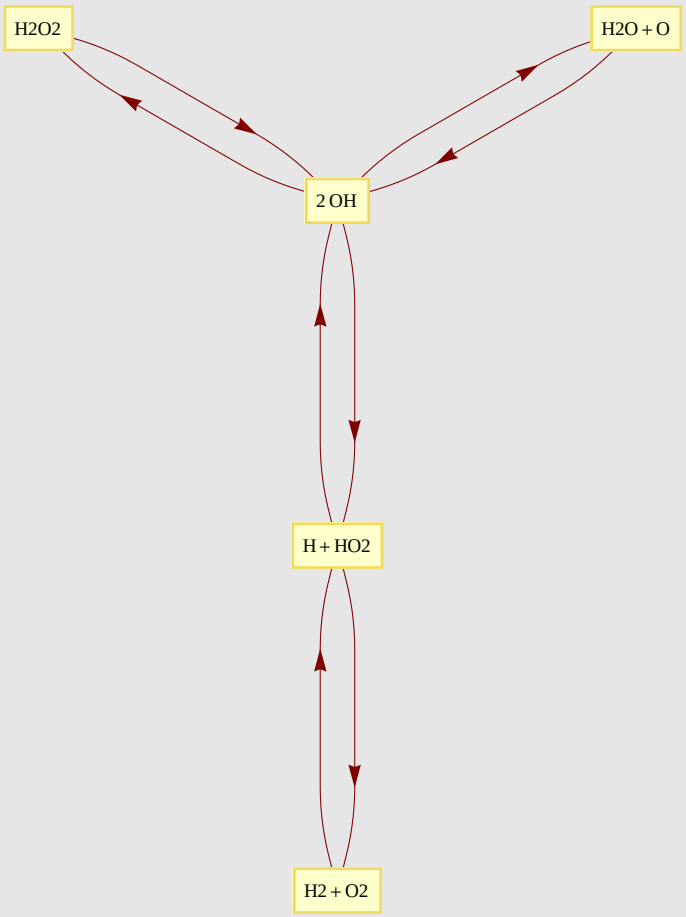


,

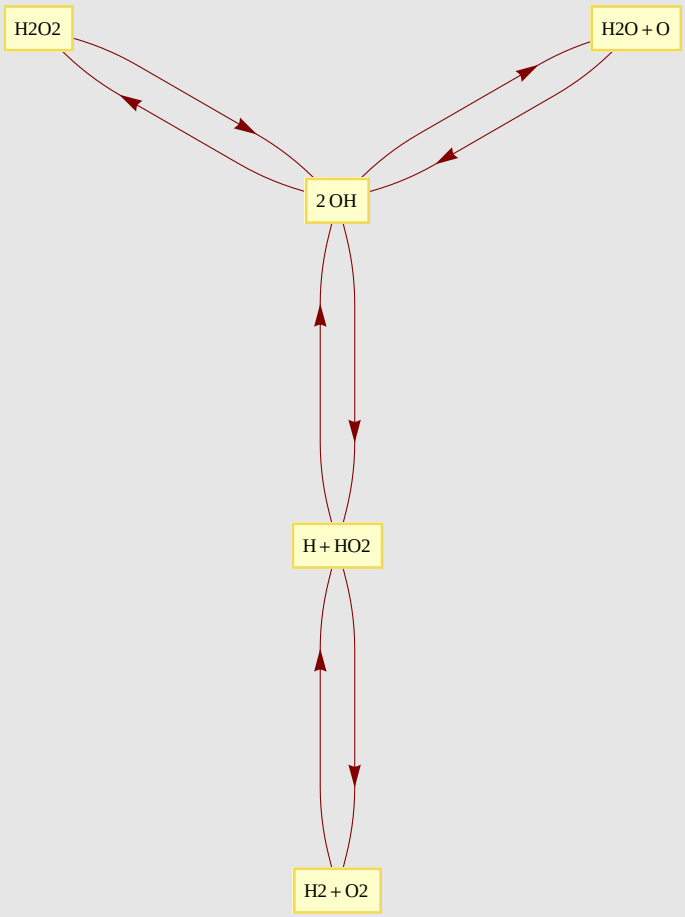
Max weakly connected component of mech Li2007



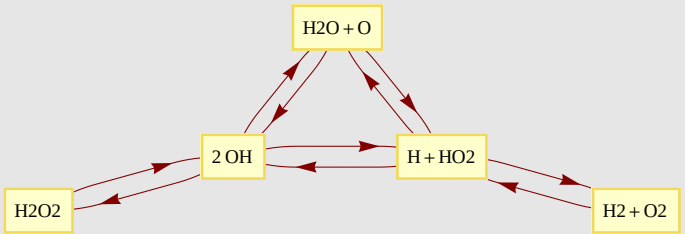
Max weakly connected component of mech NUIG2010



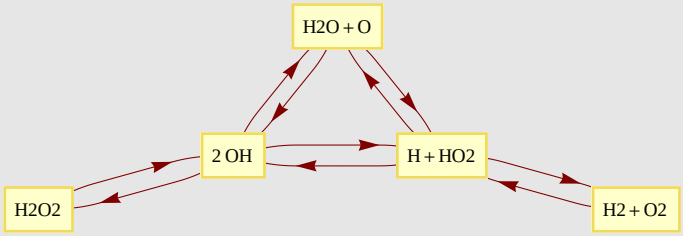
Max weakly connected component of mech OConaire2004



Max weakly connected component of mech Rasmussen2008

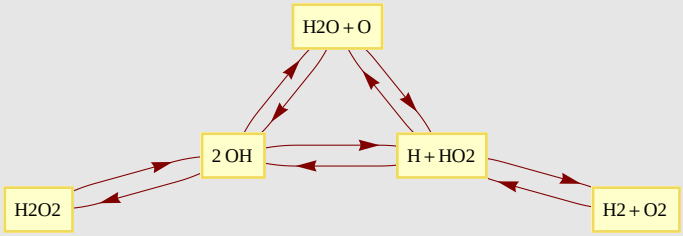


Max weakly connected component of mech SanDiego2011



,

Max weakly connected component of mech SaxenaWilliams2006



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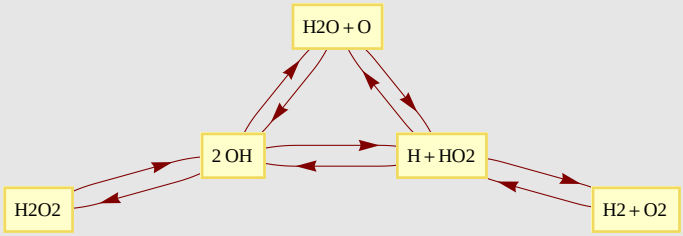
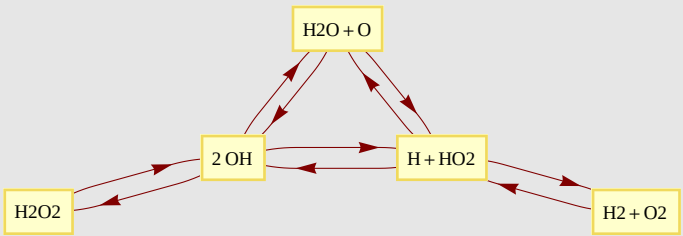
Max weakly connected component of mech Starik2009



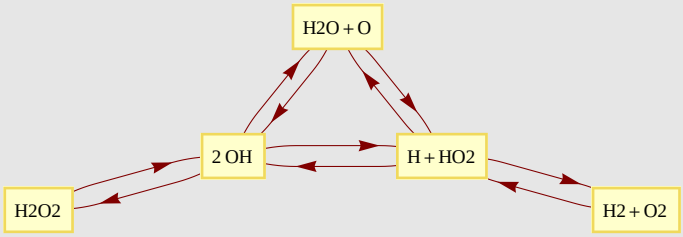
,

Max weakly connected component of mech Sun2007



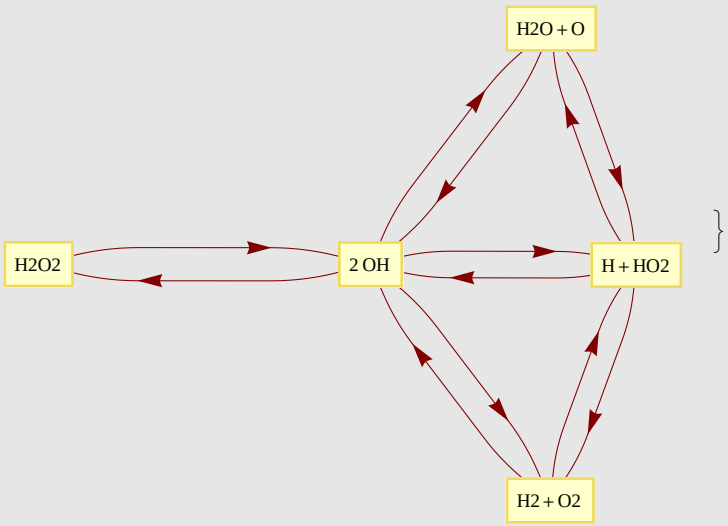
,

Max weakly connected component of mech USC2007



,

Max weakly connected component of mech Zsely2005




```
TableForm[
 tt = Table[TrueQ[(hevery[[i, 2]] /. "HV" → 0) == (hevery[[j, 2]] /. "HV" → 0)] /.
    {True → Style["TRUE", Bold]}, {i, 19}, {j, 19}],
 TableHeadings → {hdata, hdata}]
```

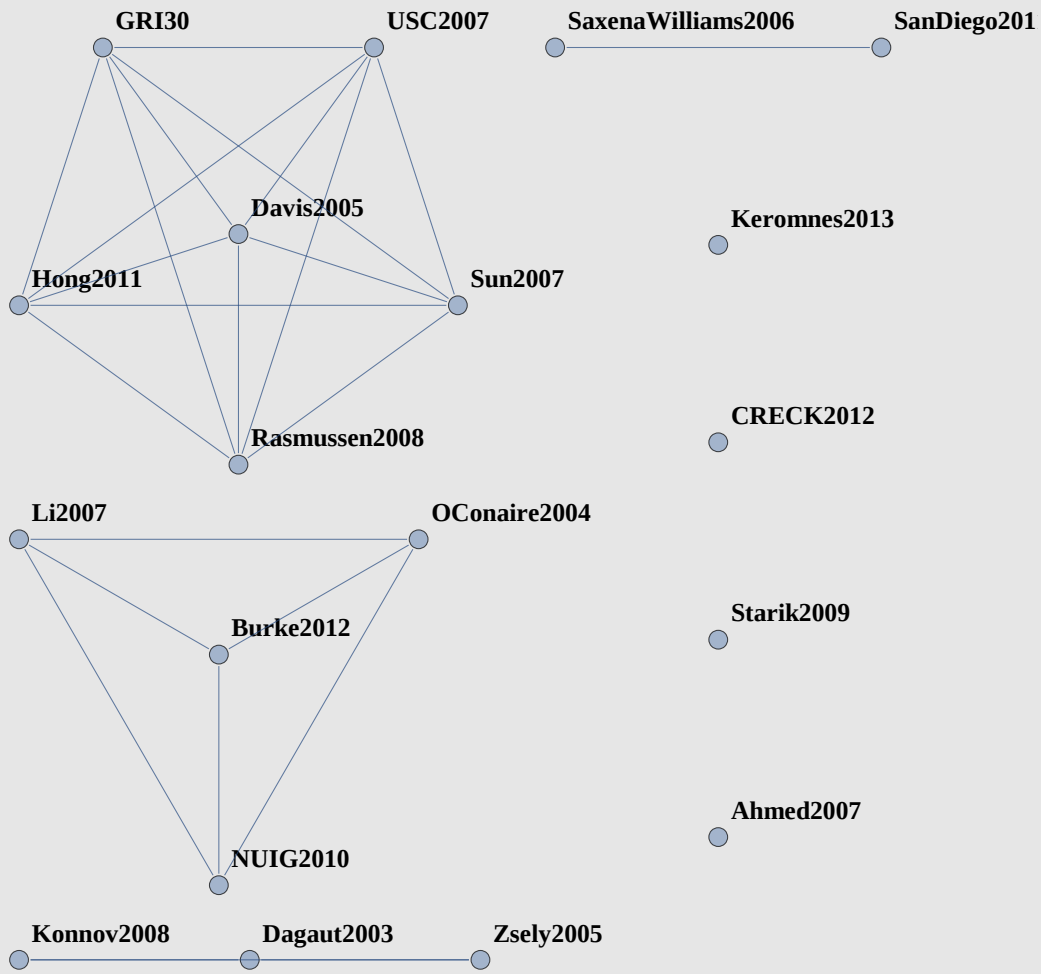
	Ahmed2007	Burke2012	CRECK2012	Dagaut2003	Davi
Ahmed2007	**TRUE**	False	False	False	Fals
Burke2012	False	**TRUE**	False	False	Fals
CRECK2012	False	False	**TRUE**	False	Fals
Dagaut2003	False	False	False	**TRUE**	Fals
Davis2005	False	False	False	False	**TRUE**
GRI30	False	False	False	False	**TRUE**
Hong2011	False	False	False	False	**TRUE**
Keromnes2013	False	False	False	False	Fals
Konnov2008	False	False	False	**TRUE**	Fals
Li2007	False	**TRUE**	False	False	Fals
NUIG2010	False	**TRUE**	False	False	Fals
OConaire2004	False	**TRUE**	False	False	Fals
Rasmussen2008	False	False	False	False	**TRUE**
SanDiego2011	False	False	False	False	Fals
SaxenaWilliams2006	False	False	False	False	Fals
Starik2009	False	False	False	False	Fals
Sun2007	False	False	False	False	**TRUE**
USC2007	False	False	False	False	**TRUE**
Zsely2005	False	False	False	**TRUE**	Fals

```
TableForm[Table[TrueQ[(hevery[[i, 2]] /. "HV" → 0) == (hevery[[j, 2]] /. "HV" → 0)] /.
    {True → Style["T", Bold, Red], False → Style["F", Bold, Blue]},
  {i, 19}, {j, 19}], TableHeadings → {indices, indices}]
```

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	T	F	F	F	F	F	F	F	F	F	F	F	F	F	F
2	F	T	F	F	F	F	F	F	F	T	T	T	F	F	F
3	F	F	T	F	F	F	F	F	F	F	F	F	F	F	F
4	F	F	F	T	F	F	F	F	T	F	F	F	F	F	F
5	F	F	F	F	T	T	T	F	F	F	F	F	T	F	F
6	F	F	F	F	T	T	T	F	F	F	F	F	T	F	F
7	F	F	F	F	T	T	T	F	F	F	F	F	T	F	F
8	F	F	F	F	F	F	F	T	F	F	F	F	F	F	F
9	F	F	F	T	F	F	F	F	T	F	F	F	F	F	F
10	F	T	F	F	F	F	F	F	F	T	T	T	F	F	F
11	F	T	F	F	F	F	F	F	F	T	T	T	F	F	F
12	F	T	F	F	F	F	F	F	F	T	T	T	F	F	F
13	F	F	F	F	T	T	T	F	F	F	F	F	T	F	F
14	F	F	F	F	F	F	F	F	F	F	F	F	F	T	T
15	F	F	F	F	F	F	F	F	F	F	F	F	F	T	T
16	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
17	F	F	F	F	T	T	T	F	F	F	F	F	T	F	F
18	F	F	F	F	T	T	T	F	F	F	F	F	T	F	F
19	F	F	F	T	F	F	F	F	T	F	F	F	F	F	F

```
ag = (tt /. {Style["TRUE", Bold] → 1, False → 0}) - IdentityMatrix[19];
```

```
AdjacencyGraph[ag, ImageSize → 550, ImagePadding → 60, VertexLabels →
  Thread[Rule[indices, Style[#, Bold, 12] & /@ hevery[[indices, 3]]]]]
```




```
wc = ConnectedComponents[AdjacencyGraph[ag]] /.
   Thread[Rule[indices, hevery[[indices, 3]]]];
```

```
TableForm[wc, TableHeadings → {Range[8], None}]
```

```
1    Ahmed2007
2    Burke2012       Li2007                NUIG2010     OConaire2004
3    CRECK2012
4    Dagaut2003      Konnov2008            Zsely2005
5    Davis2005       GRI30                 Hong2011     Rasmussen2008    Sun20
6    Keromnes2013
7    SanDiego2011    SaxenaWilliams2006
8    Starik2009
```

```
reducedindices = Sort[First /@ ConnectedComponents[AdjacencyGraph[ag]]]
```

```
{1, 2, 3, 4, 5, 8, 14, 16}
```

```
Column[
 Riffle[Row /@ (Join[{Style[hevery[[#, 3]], Bold, 14], "\t"}, VolpertIndexing[
        hevery[[#, 2]], {"H2", "O2"}, Verbose → True,
        ExternalSpecies → {"HV"}]] & /@ reducedindices), "\n\n"], 2]
```

Ahmed2007

Species	Indices
O2	0
H2	0
O	1
HO2	1
H	1
H2O2	2
OH	2
H2O	2

Reaction steps	Indices
$O2 \to 2\,O$	0
$H2 + O2 \to H + HO2$	0
$H2 \to 2\,H$	0
$H + O2 \to O + OH$	1
$HO2 + O \to O2 + OH$	1
$H2 + O \to H + OH$	1
$2\,O \to O2$	1
$H + HO2 \to 2\,OH$	1
$H + HO2 \to H2 + O2$	1
$H + HO2 \to H2O + O$	1
$2\,HO2 \to H2O2 + O2$	1
$H + O2 \to HO2$	1
$HO2 \to H + O2$	1
$H2 + HO2 \to H + H2O2$	1
$2\,H \to H2$	1
$HO2 + OH \to H2O + O2$	2
$H2O + O2 \to HO2 + OH$	2
$O + OH \to H + O2$	2
$O2 + OH \to HO2 + O$	2
$HO2 + OH \to H2O2 + O$	2
$H2O2 + O \to HO2 + OH$	2
$2\,OH \to H2O + O$	2
$H2O + O \to 2\,OH$	2
$H + OH \to H2 + O$	2
$H2O2 + OH \to H2O + HO2$	2
$H2O + HO2 \to H2O2 + OH$	2
$2\,OH \to H + HO2$	2
$H2O + O \to H + HO2$	2
$H2O2 + O2 \to 2\,HO2$	2
$H2O + OH \to H + H2O2$	2
$H + H2O2 \to H2O + OH$	2
$H + H2O2 \to H2 + HO2$	2
$2\,OH \to H2O2$	2
$H2O2 \to 2\,OH$	2
$H2 + OH \to H + H2O$	2
$H + H2O \to H2 + OH$	2
$H + OH \to H2O$	2
$H2O \to H + OH$	2

Burke2012

Species	Indices
O_2	0
H_2	0
O	1
HO_2	1
H	1
H_2O_2	2
OH	2
H_2O	3

Reaction steps	Indices
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$2\,O \to O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,H \to H_2$	1
$HO_2 + OH \to H_2O + O_2$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$2\,OH \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + OH \to H_2O$	2
$H_2O + O_2 \to HO_2 + OH$	3
$H_2O + O \to 2\,OH$	3
$H_2O + HO_2 \to H_2O_2 + OH$	3
$H_2O + OH \to H + H_2O_2$	3
$H + H_2O \to H_2 + OH$	3
$H_2O \to H + OH$	3

CRECK2012

Species	Indices
O_2	0
H_2	0
H	1
HO_2	1
O	1
OH	2
H_2O_2	2
H_2O	3

Reaction steps	Indices
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$H_2 + O \to H + OH$	1
$2\,O \to O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$HO_2 \to O + OH$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,H \to H_2$	1
$HO_2 + OH \to H_2O + O_2$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$2\,OH \to H_2O + O$	2
$H + OH \to H_2 + O$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$2\,OH \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$O + OH \to HO_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + OH \to H_2O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$H_2O + O_2 \to HO_2 + OH$	3
$H_2O + O \to 2\,OH$	3
$H_2O + HO_2 \to H_2O_2 + OH$	3
$H_2O + OH \to H + H_2O_2$	3
$H + H_2O \to H_2 + OH$	3
$H_2O \to H + OH$	3

Dagaut2003

Species	Indices
O_2	0
H_2	0
O	1
HO_2	1
OH	1
H	1
H_2O_2	2
H_2O	2

Reaction steps	Indices
$H_2 + O_2 \to 2\,OH$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$H_2 \to 2\,H$	0
$HO_2 + OH \to H_2O + O_2$	1
$2\,OH \to H_2 + O_2$	1
$O + OH \to H + O_2$	1
$H + O_2 \to O + OH$	1
$O_2 + OH \to HO_2 + O$	1
$HO_2 + O \to O_2 + OH$	1
$HO_2 + OH \to H_2O_2 + O$	1
$2\,OH \to H_2O + O$	1
$H + OH \to H_2 + O$	1
$H_2 + O \to H + OH$	1
$OH \to H + O$	1
$H + O \to OH$	1
$2\,O \to O_2$	1
$2\,OH \to H + HO_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,OH \to H_2O_2$	1
$H_2 + OH \to H + H_2O$	1
$H + OH \to H_2O$	1
$2\,H \to H_2$	1
$H_2O + O_2 \to HO_2 + OH$	2
$H_2O_2 + O \to HO_2 + OH$	2
$H_2O + O \to 2\,OH$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$H_2O + O \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$H_2O_2 \to 2\,OH$	2
$H + H_2O \to H_2 + OH$	2
$H_2O \to H + OH$	2

Davis2005

Species	Indices
O_2	0
H_2	0
O	1
HO_2	1
H	1
H_2O_2	2
OH	2
H_2O	2

Reaction steps	Indices
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$2\,O \to O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,H \to H_2$	1
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2
$H_2O + O \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + H_2O \to H_2 + OH$	2
$H + OH \to H_2O$	2
$H_2O \to H + OH$	2

Keromnes2013

Species	Indices
O2	0
H2	0
O	1
HO2	1
H	1
OHEX	2
H2O2	2
OH	2
H2O	3

Reaction steps	Indices
$O2 \to 2\,O$	0
$H2 + O2 \to H + HO2$	0
$H2 \to 2\,H$	0
$H + O2 \to O + OH$	1
$HO2 + O \to O2 + OH$	1
$H2 + O \to H + OH$	1
$H + O \to OHEX$	1
$H + O \to OH$	1
$2\,O \to O2$	1
$H + HO2 \to 2\,OH$	1
$H + HO2 \to H2 + O2$	1
$2\,HO2 \to H2O2 + O2$	1
$H + O2 \to HO2$	1
$HO2 \to H + O2$	1
$H2 + HO2 \to H + H2O2$	1
$2\,H \to H2$	1
$OHEX \to OH$	2
$OH \to OHEX$	2
$HO2 + OH \to H2O + O2$	2
$O + OH \to H + O2$	2
$O2 + OH \to HO2 + O$	2
$HO2 + OH \to H2O2 + O$	2
$H2O2 + O \to HO2 + OH$	2
$2\,OH \to H2O + O$	2
$H + OH \to H2 + O$	2
$OHEX \to H + O$	2
$OH \to H + O$	2
$H2O2 + OH \to H2O + HO2$	2
$2\,OH \to H + HO2$	2
$H2O2 + O2 \to 2\,HO2$	2
$H + H2O2 \to H2O + OH$	2
$H + H2O2 \to H2 + HO2$	2
$2\,OH \to H2O2$	2
$H2O2 \to 2\,OH$	2
$H2 + OH \to H + H2O$	2
$H + OH \to H2O$	2
$H2O + O2 \to HO2 + OH$	3
$H2O + O \to 2\,OH$	3
$H2O + HO2 \to H2O2 + OH$	3
$H2O + OH \to H + H2O2$	3
$H + H2O \to H2 + OH$	3
$H2O \to H + OH$	3

SanDiego2011

Species	Indices
O_2	0
H_2	0
O	1
HO_2	1
H	1
H_2O_2	2
OH	2
H_2O	2

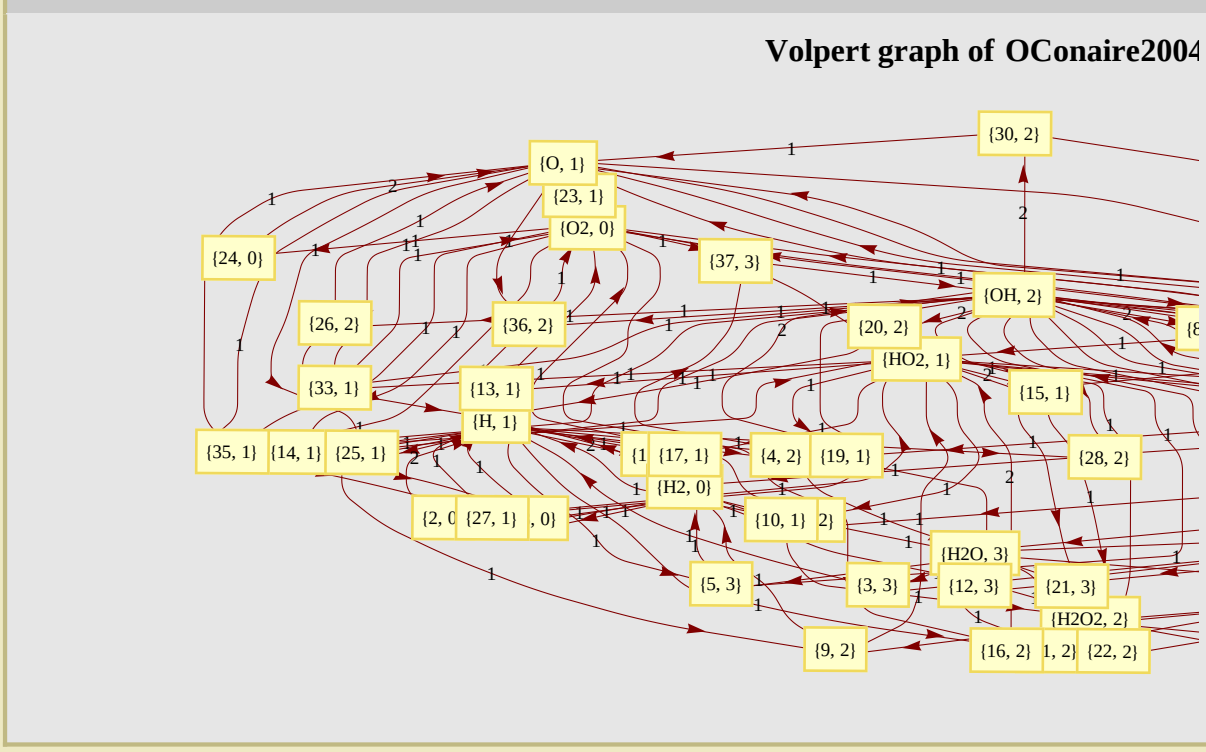
Reaction steps	Indices
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$2\,O \to O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$HO_2 \to O + OH$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,H \to H_2$	1
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2
$H_2O + O \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$O + OH \to HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + H_2O \to H_2 + OH$	2
$H + OH \to H_2O$	2
$H_2O \to H + OH$	2

Starik2009

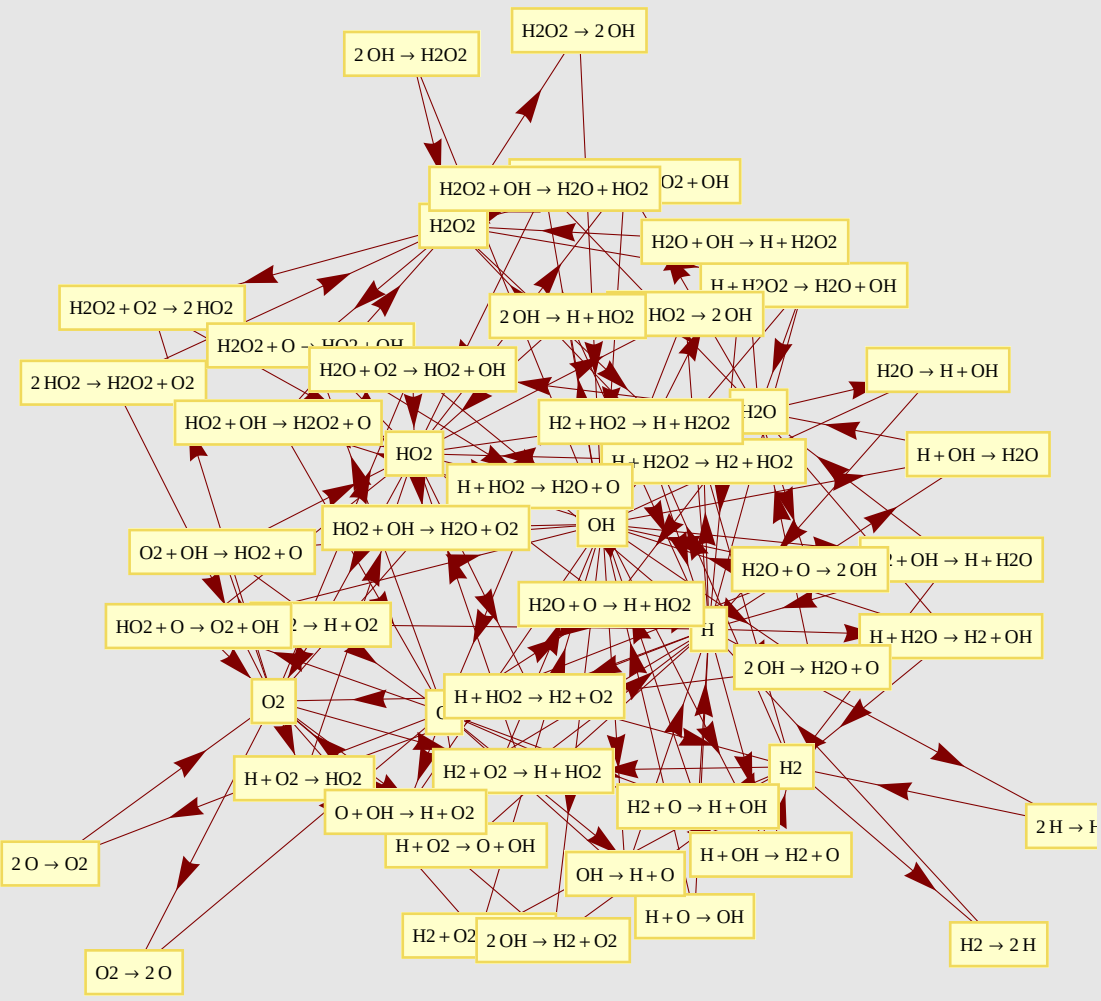
Species	Indices
O_2	0
H_2	0
O_3	1
O	1
HO_2	1
H	1
H_2O_2	2
OH	2
H_2O	2

Reaction steps	Indices
$2\,O_2 \to O + O_3$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$H_2 \to 2\,H$	0
$HO_2 + O_3 \to 2\,O_2 + OH$	1
$H_2 + O_3 \to HO_2 + OH$	1
$H + O_3 \to O_2 + OH$	1
$O_3 \to O + O_2$	1
$O + O_2 \to O_3$	1
$HO_2 + O_2 \to O_3 + OH$	1
$H + O_2 \to O + OH$	1
$O + O_3 \to 2\,O_2$	1
$HO_2 + O \to O_2 + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$2\,O \to O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,H \to H_2$	1
$2\,O_2 + OH \to HO_2 + O_3$	2
$HO_2 + OH \to H_2 + O_3$	2
$O_2 + OH \to H + O_3$	2
$O_3 + OH \to HO_2 + O_2$	2
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2
$H_2O + O \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + H_2O \to H_2 + OH$	2
$H + OH \to H_2O$	2
$H_2O \to H + OH$	2

```
ShowVolpertGraph[hevery[[12, 2]], PlotFunction → "LayeredGraphPlot",
 DirectedEdges → True, VertexLabeling → True, ImageSize → 900,
 PlotLabel → Style["Volpert graph of " <> hevery[[12, 3]], 15, Bold, Black],
 EdgeLabeling → True, Numbered → True, Indexed → {"H2", "O2"},
 MultiedgeStyle → True, PlotRangeClipping → True]
```



```
ShowVolpertGraph[hevery[[19, 2]], MultiedgeStyle → True,
 DirectedEdges → True, VertexLabeling → True,
 PlotLabel → Style["Volpert graph of " <> hevery[[19, 3]], 15, Bold, Black],
 ImageSize → 600]
```




```
ReversibleQ /@ hevery[[reducedindices, 2]]
```

```
{True, True, False, True, True, True, True, True}
```

```
db = Sort[DetailedBalanced[#], Total[Length /@ (#1 /. Equal → List)] <
      Total[Length /@ (#2 /. Equal → List)] &] & /@
  hevery[[Delete[reducedindices, 3], 2]]
```

DetailedBalanced::nocycle :

The FHJ−graph of the given formal mechanism has no cycle, so we are given only the spanning forest condition(s).

$$\Big\{\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_2\,k_{14}\,k_{19} == k_1\,k_{13}\,k_{20},\ k_4\,k_{13}\,k_{37} == k_3\,k_{14}\,k_{38},\ k_{18}\,k_{21}\,k_{30} == k_{17}\,k_{22}\,k_{29},\ k_2\,k_9\,k_{14}\,k_{15} == k_1\,k_{10}\,k_{13}\,k_{16},\ k_2\,k_8\,k_9\,k_{21} == k_1\,k_7\,k_{10}\,k_{22},\ k_2\,k_4\,k_9\,k_{23} == k_1\,k_3\,k_{10}\,k_{24},\ k_2\,k_4\,k_{28}\,k_{29} == k_1\,k_3\,k_{27}\,k_{30},\ k_3\,k_{14}\,k_{30}\,k_{33} == k_4\,k_{13}\,k_{29}\,k_{34},\ k_1\,k_3\,k_{10}\,k_{30}\,k_{31} == k_2\,k_4\,k_9\,k_{29}\,k_{32},\ k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{26}\,k_{29}^2 == k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{25}\,k_{30}^2,\ k_2\,k_4\,k_8\,k_9\,k_{13}\,k_{29}\,k_{35} == k_1\,k_3\,k_7\,k_{10}\,k_{14}\,k_{30}\,k_{36}\Big\},$$

$$\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_2\,k_{14}\,k_{17} == k_1\,k_{13}\,k_{18},\ k_4\,k_{13}\,k_{37} == k_3\,k_{14}\,k_{38},\ k_2\,k_9\,k_{14}\,k_{15} == k_1\,k_{10}\,k_{13}\,k_{16},\ k_2\,k_8\,k_9\,k_{19} == k_1\,k_7\,k_{10}\,k_{20},\ k_2\,k_4\,k_9\,k_{21} == k_1\,k_3\,k_{10}\,k_{22},\ k_2\,k_8\,k_9\,k_{13}\,k_{24}\,k_{25}^2 == k_1\,k_7\,k_{10}\,k_{14}\,k_{23}\,k_{26}^2,\ k_1\,k_8\,k_9\,k_{13}\,k_{24}\,k_{27}^2 == k_2\,k_7\,k_{10}\,k_{14}\,k_{23}\,k_{28}^2,\ k_1\,k_8\,k_{10}\,k_{13}\,k_{24}\,k_{31}^2 == k_2\,k_7\,k_9\,k_{14}\,k_{23}\,k_{32}^2,\ k_2\,k_8\,k_9\,k_{14}\,k_{24}\,k_{33}^2 == k_1\,k_7\,k_{10}\,k_{13}\,k_{23}\,k_{34}^2,\ k_2\,k_8\,k_9\,k_{13}\,k_{23}\,k_{35}^2 == k_1\,k_7\,k_{10}\,k_{14}\,k_{24}\,k_{36}^2,\ k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{24}\,k_{29}^2 == k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{23}\,k_{30}^2\Big\},$$

$$\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_4\,k_{28}\,k_{31} == k_3\,k_{27}\,k_{32},\ k_4\,k_{13}\,k_{41} == k_3\,k_{14}\,k_{42},\ k_{20}\,k_{21}\,k_{40} == k_{19}\,k_{22}\,k_{39},\ k_{18}\,k_{21}\,k_{32} == k_{17}\,k_{22}\,k_{31},\ k_2\,k_9\,k_{14}\,k_{15} == k_1\,k_{10}\,k_{13}\,k_{16},\ k_2\,k_8\,k_9\,k_{21} == k_1\,k_7\,k_{10}\,k_{22},\ k_8\,k_9\,k_{13}\,k_{39} == k_7\,k_{10}\,k_{14}\,k_{40},\ k_2\,k_4\,k_9\,k_{23} == k_1\,k_3\,k_{10}\,k_{24},\ k_2\,k_4\,k_{30}\,k_{31} == k_1\,k_3\,k_{29}\,k_{32},\ k_3\,k_{14}\,k_{32}\,k_{35} == k_4\,k_{13}\,k_{31}\,k_{36},\ k_1\,k_3\,k_{10}\,k_{32}\,k_{33} == k_2\,k_4\,k_9\,k_{31}\,k_{34},\ k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{26}\,k_{31}^2 == k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{25}\,k_{32}^2,\ k_2\,k_4\,k_8\,k_9\,k_{13}\,k_{31}\,k_{37} == k_1\,k_3\,k_7\,k_{10}\,k_{14}\,k_{32}\,k_{38}\Big\},$$

$$\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_2\,k_{14}\,k_{19} == k_1\,k_{13}\,k_{20},\ k_4\,k_{28}\,k_{31} == k_3\,k_{27}\,k_{32},\ k_4\,k_{13}\,k_{39} == k_3\,k_{14}\,k_{40},\ k_{18}\,k_{21}\,k_{32} == k_{17}\,k_{22}\,k_{31},\ k_2\,k_9\,k_{14}\,k_{15} == k_1\,k_{10}\,k_{13}\,k_{16},\ k_2\,k_8\,k_9\,k_{21} == k_1\,k_7\,k_{10}\,k_{22},\ k_2\,k_4\,k_9\,k_{23} == k_1\,k_3\,k_{10}\,k_{24},\ k_2\,k_4\,k_{30}\,k_{31} == k_1\,k_3\,k_{29}\,k_{32},\ k_3\,k_{14}\,k_{32}\,k_{35} == k_4\,k_{13}\,k_{31}\,k_{36},\ k_1\,k_3\,k_{10}\,k_{32}\,k_{33} == k_2\,k_4\,k_9\,k_{31}\,k_{34},\ k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{26}\,k_{31}^2 == k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{25}\,k_{32}^2,\ k_2\,k_4\,k_8\,k_9\,k_{13}\,k_{31}\,k_{37} == k_1\,k_3\,k_7\,k_{10}\,k_{14}\,k_{32}\,k_{38}\Big\},$$

$$\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_2\,k_{14}\,k_{17} == k_1\,k_{13}\,k_{18},\ k_4\,k_{13}\,k_{39} == k_3\,k_{14}\,k_{40},\ k_{26}\,k_{27}\,k_{42} == k_{25}\,k_{28}\,k_{41},\ k_2\,k_9\,k_{14}\,k_{15} == k_1\,k_{10}\,k_{13}\,k_{16},\ k_2\,k_8\,k_9\,k_{19} == k_1\,k_7\,k_{10}\,k_{20},\ k_2\,k_4\,k_9\,k_{21} == k_1\,k_3\,k_{10}\,k_{22},\ k_2\,k_8\,k_9\,k_{13}\,k_{24}\,k_{25}^2 == k_1\,k_7\,k_{10}\,k_{14}\,k_{23}\,k_{26}^2,\ k_1\,k_8\,k_9\,k_{13}\,k_{24}\,k_{29}^2 == k_2\,k_7\,k_{10}\,k_{14}\,k_{23}\,k_{30}^2,\ k_1\,k_8\,k_{10}\,k_{13}\,k_{24}\,k_{33}^2 == k_2\,k_7\,k_9\,k_{14}\,k_{23}\,k_{34}^2,\ k_2\,k_8\,k_9\,k_{14}\,k_{24}\,k_{35}^2 == k_1\,k_7\,k_{10}\,k_{13}\,k_{23}\,k_{36}^2,\ k_2\,k_8\,k_9\,k_{13}\,k_{23}\,k_{37}^2 == k_1\,k_7\,k_{10}\,k_{14}\,k_{24}\,k_{38}^2,\ k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{24}\,k_{31}^2 == k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{23}\,k_{32}^2\Big\},$$

$$\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_2\,k_{14}\,k_{21} == k_1\,k_{13}\,k_{22},\ k_8\,k_{15}\,k_{35} == k_7\,k_{16}\,k_{36},\ k_4\,k_{13}\,k_{41} == k_3\,k_{14}\,k_{42},\ k_{20}\,k_{23}\,k_{34} == k_{19}\,k_{24}\,k_{33},\ k_{14}\,k_{15}\,k_{40} == k_{13}\,k_{16}\,k_{39},\ k_2\,k_9\,k_{14}\,k_{17} == k_1\,k_{10}\,k_{13}\,k_{18},\ k_2\,k_8\,k_9\,k_{23} == k_1\,k_7\,k_{10}\,k_{24},\ k_2\,k_4\,k_9\,k_{25} == k_1\,k_3\,k_{10}\,k_{26},\ k_8\,k_9\,k_{15}\,k_{31} == k_7\,k_{10}\,k_{16}\,k_{32},\ k_2\,k_8\,k_9\,k_{15}\,k_{29} == k_1\,k_7\,k_{10}\,k_{16}\,k_{30},\ k_2\,k_4\,k_8\,k_9\,k_{15}\,k_{33} == k_1\,k_3\,k_7\,k_{10}\,k_{16}\,k_{34},\ k_2\,k_8\,k_9\,k_{14}\,k_{15}^2\,k_{27} == k_1\,k_7\,k_{10}\,k_{13}\,k_{16}^2\,k_{28},\ k_2\,k_8\,k_9\,k_{14}\,k_{15}\,k_{37} == k_1\,k_7\,k_{10}\,k_{13}\,k_{16}\,k_{38}\Big\},$$

$$\Big\{k_2\,k_4\,k_5 == k_1\,k_3\,k_6,\ k_3\,k_8\,k_{11} == k_4\,k_7\,k_{12},\ k_2\,k_{14}\,k_{19} == k_1\,k_{13}\,k_{20},\ k_4\,k_{28}\,k_{31} == k_3\,k_{27}\,k_{32},\ k_4\,k_{13}\,k_{41} == k_3\,k_{14}\,k_{42},\ k_{18}\,k_{21}\,k_{32} == k_{17}\,k_{22}\,k_{31},\ k_2\,k_9\,k_{14}\,k_{15} == k_1\,k_{10}\,k_{13}\,k_{16},\ k_2\,k_8\,k_9\,k_{21} == k_1\,k_7\,k_{10}\,k_{22},\ k_2\,k_4\,k_9\,k_{23} == k_1\,k_3\,k_{10}\,k_{24},\ k_2\,k_4\,k_{30}\,k_{31} == k_1\,k_3\,k_{29}\,k_{32},\ k_3\,k_{14}\,k_{32}\,k_{35} == k_4\,k_{13}\,k_{31}\,k_{36},\ k_1\,k_3\,k_{10}\,k_{32}\,k_{33} == k_2\,k_4\,k_9\,k_{31}\,k_{34},\ k_3\,k_{14}\,k_{32}\,k_{38}\,k_{43} == k_4\,k_{13}\,k_{31}\,k_{37}\,k_{44},\ k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{26}\,k_{31}^2 == k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{25}\,k_{32}^2,\ k_2\,k_4\,k_8\,k_9\,k_{13}\,k_{31}\,k_{39} == k_1\,k_3\,k_7\,k_{10}\,k_{14}\,k_{32}\,k_{40},\ k_4\,k_8\,k_9\,k_{13}^2\,k_{31}\,k_{37}\,k_{49} == k_3\,k_7\,k_{10}\,k_{14}^2\,k_{32}\,k_{38}\,k_{50},\ k_2\,k_4\,k_8\,k_9\,k_{31}\,k_{37}\,k_{51} == k_1\,k_3\,k_7\,k_{10}\,k_{32}\,k_{38}\,k_{52},\ k_1\,k_3^2\,k_7\,k_{10}\,k_{14}\,k_{32}^2\,k_{38}\,k_{45} == k_2\,k_4^2\,k_8\,k_9\,k_{13}\,k_{31}^2\,k_{37}\,k_{46},\ k_2\,k_4\,k_8\,k_9\,k_{13}\,k_{31}\,k_{37}\,k_{47} == k_1\,k_3\,k_7\,k_{10}\,k_{14}\,k_{32}\,k_{38}\,k_{48}\Big\}\Big\}$$

TableForm[db, TableHeadings → {hevery⟦Delete[reducedindices, 3], 3⟧}]

Ahmed2007	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_2 k_{14} k_{19} == k_1 k_{13} k_{20}$	k_4
Burke2012	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_2 k_{14} k_{17} == k_1 k_{13} k_{18}$	k_4
Dagaut2003	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_4 k_{28} k_{31} == k_3 k_{27} k_{32}$	k_4
Davis2005	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_2 k_{14} k_{19} == k_1 k_{13} k_{20}$	k_4
Keromnes2013	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_2 k_{14} k_{17} == k_1 k_{13} k_{18}$	k_4
SanDiego2011	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_2 k_{14} k_{21} == k_1 k_{13} k_{22}$	k_8
Starik2009	$k_2 k_4 k_5 == k_1 k_3 k_6$	$k_3 k_8 k_{11} == k_4 k_7 k_{12}$	$k_2 k_{14} k_{19} == k_1 k_{13} k_{20}$	k_4

```
TableForm[Table[
  Complement[ReactionsData[hevery[[i, 2]], ExternalSpecies → "HV"]["fhjgraph"],
   ReactionsData[hevery[[j, 2]], ExternalSpecies → "HV"]["fhjgraph"]],
  {i, reducedindices}, {j, reducedindices}],
 TableHeadings → {hevery[[reducedindices, 3]], hevery[[reducedindices, 3]]}]
```

	Ahmed2007	Burke2012	CRECK2012
Ahmed2007		H + HO2 → H2O + O H2O + O → H + HO2	H + HO2 → H2O + O H2O + O → H + HO2 HO2 + OH → H2O2 + O
Burke2012	H + O → OH OH → H + O		H + O → OH OH → H + O HO2 + OH → H2O2 + O
CRECK2012	HO2 → O + OH O + OH → HO2	HO2 → O + OH O + OH → HO2	
Dagaut2003	H + O → OH H2 + O2 → 2 OH OH → H + O 2 OH → H2 + O2	H + HO2 → H2O + O H2O + O → H + HO2 H2 + O2 → 2 OH 2 OH → H2 + O2	H + HO2 → H2O + O H + O → OH H2O + O → H + HO2 H2 + O2 → 2 OH OH → H + O 2 OH → H2 + O2 HO2 + OH → H2O2 + O
Davis2005	H + O → OH OH → H + O	H + HO2 → H2O + O H2O + O → H + HO2	H + HO2 → H2O + O H + O → OH H2O + O → H + HO2 OH → H + O HO2 + OH → H2O2 + O
Keromnes2013	H + O → OH H + O → OHEX OH → H + O OH → OHEX OHEX → H + O OHEX → OH	H + O → OHEX OH → OHEX OHEX → H + O OHEX → OH	H + O → OH H + O → OHEX OH → H + O OH → OHEX HO2 + OH → H2O2 + O OHEX → H + O OHEX → OH
SanDiego2011	HO2 → O + OH H + O → OH OH → H + O O + OH → HO2	HO2 → O + OH H + HO2 → H2O + O H2O + O → H + HO2 O + OH → HO2	H + HO2 → H2O + O H + O → OH H2O + O → H + HO2 OH → H + O HO2 + OH → H2O2 + O
Starik2009	H + O → OH 2 O2 → O + O3 HO2 + O2 → O3 + OH O + O2 → O3 O3 → O + O2 H + O3 → O2 + OH H2 + O3 → HO2 + OH HO2 + O3 → 2 O2 + OH O + O3 → 2 O2 OH → H + O HO2 + OH → H2 + O3 O2 + OH → H + O3 2 O2 + OH → HO2 + O3 O3 + OH → HO2 + O2	H + HO2 → H2O + O H2O + O → H + HO2 2 O2 → O + O3 HO2 + O2 → O3 + OH O + O2 → O3 O3 → O + O2 H + O3 → O2 + OH H2 + O3 → HO2 + OH HO2 + O3 → 2 O2 + OH O + O3 → 2 O2 HO2 + OH → H2 + O3 O2 + OH → H + O3 2 O2 + OH → HO2 + O3 O3 + OH → HO2 + O2	H + HO2 → H2O + O H + O → OH H2O + O → H + HO2 2 O2 → O + O3 HO2 + O2 → O3 + OH O + O2 → O3 O3 → O + O2 H + O3 → O2 + OH H2 + O3 → HO2 + OH HO2 + O3 → 2 O2 + OH O + O3 → 2 O2 OH → H + O HO2 + OH → H2O2 + O HO2 + OH → H2 + O3 O2 + OH → H + O3 2 O2 + OH → HO2 + O3 O3 + OH → HO2 + O2

```
TableForm[Table[Length@Complement[
    ReactionsData[hevery[[i, 2]], ExternalSpecies → "HV"]["fhjgraph"],
    ReactionsData[hevery[[j, 2]], ExternalSpecies → "HV"]["fhjgraph"]],
  {i, reducedindices}, {j, reducedindices}],
 TableHeadings → {hevery[[reducedindices, 3]], hevery[[reducedindices, 3]]}]
```

	Ahmed2007	Burke2012	CRECK2012	Dagaut2003	Davis2005
Ahmed2007	0	2	3	0	0
Burke2012	2	0	3	0	0
CRECK2012	2	2	0	2	2
Dagaut2003	4	4	7	0	2
Davis2005	2	2	5	0	0
Keromnes2013	6	4	7	4	4
SanDiego2011	4	4	5	2	2
Starik2009	14	14	17	12	12

Carbon monoxide combustion mechanisms

```
SetDirectory[NotebookDirectory[] <> "CO"];
```

```
ClearAll[codat, codata];
codat = Flatten[Import["names_CO.txt", "Table"]];
codata = StringReplace[#, ".dat" → ""] & /@ codat
```

```
{Ahmed2007, CRECK2012, Dagaut2003, Davis2005, gri30,
 Keromnes2013, Li2007, NUIG2010, Rasmussen2008, SanDiego2011,
 SaxenaWilliams2006, Starik2009, Sun2007, USC2007, Zsely2005}
```

```
indices = Range[15];
```

```
TableForm[codata, TableHeadings → {indices, None}]
```

1	Ahmed2007
2	CRECK2012
3	Dagaut2003
4	Davis2005
5	gri30
6	Keromnes2013
7	Li2007
8	NUIG2010
9	Rasmussen2008
10	SanDiego2011
11	SaxenaWilliams2006
12	Starik2009
13	Sun2007
14	USC2007
15	Zsely2005

```
ClearAll[coall];
coall = CHEMKINImport[#]["chemkinreactions"] & /@ codat; // AbsoluteTiming
```

```
{2.3421339, Null}
```

```
ClearAll[coevery];
coevery = Transpose[{coall, DeleteAutocatalysis /@ coall, codata}]; //
 AbsoluteTiming
```

```
{0.6750386, Null}
```

```
TableForm[
 ReactionsData[#, ExternalSpecies → "HV"]["M", "R", "deficiency"] & /@
  coevery[[indices, 2]],
 TableHeadings → {coevery[[indices, 3]], {"M", "R", "deficiency"}}]
```

	M	R	deficiency
Ahmed2007	12	72	δ=n-l-s=57-23-9=25
CRECK2012	11	60	δ=n-l-s=49-19-8=22
Dagaut2003	12	68	δ=n-l-s=52-21-9=22
Davis2005	11	60	δ=n-l-s=47-19-8=20
gri30	12	74	δ=n-l-s=57-23-9=25
Keromnes2013	12	64	δ=n-l-s=52-21-9=22
Li2007	12	78	δ=n-l-s=61-24-9=28
NUIG2010	12	78	δ=n-l-s=61-24-9=28
Rasmussen2008	13	88	δ=n-l-s=66-26-10=30
SanDiego2011	12	74	δ=n-l-s=57-23-9=25
SaxenaWilliams2006	11	60	δ=n-l-s=45-18-8=19
Starik2009	13	88	δ=n-l-s=70-28-10=32
Sun2007	12	66	δ=n-l-s=52-21-9=22
USC2007	12	74	δ=n-l-s=57-23-9=25
Zsely2005	11	62	δ=n-l-s=47-19-8=20

```
TableForm[ReactionsData[#, ExternalSpecies → {"HV"}]["species"] & /@
  coevery[[indices, 2]],
 TableHeadings → {coevery[[indices, 3]], {"list", " of ", "species\n"}}]
```

	list	of	species					
Ahmed2007	CH2O	H	HCO	CO	CO2	O	H2	OH
CRECK2012	HCO	HO2	CO2	H	OH	H2O2	O	CO
Dagaut2003	CH2O	CO	HCO	CO2	O	H	H2	OH
Davis2005	CO2	CO	O	H	H2	HCO	OH	H2(
gri30	CH2O	CO	H2	H	HCO	CO2	O	OH
Keromnes2013	HCO	CO	H2	HO2	CO2	H	OH	O
Li2007	CH2O	CO	H2	H	HCO	CO2	O	OH
NUIG2010	CH2O	CO	H2	H	HCO	CO2	O	OH
Rasmussen2008	CH2O	CO	H2	H	HCO	CO2	O	HO(
SanDiego2011	CH2O	H	HCO	CO2	CO	O	H2	OH
SaxenaWilliams2006	H	H2	CO	HCO	CO2	O	OH	H2(
Starik2009	CH2O	H	HCO	CO	CO2	O	H2	OH
Sun2007	CH2O	CO	HCO	CO2	O	H	H2	OH
USC2007	CH2O	CO	H2	H	HCO	CO2	O	OH
Zsely2005	CO2	CO	O	H	H2	HCO	OH	H2(

```
TableForm[Table[coevery[[i, 2]] /. x_Equilibrium → Sequence[], {i, 15}],
 TableHeadings → {coevery[[indices, 3]], None}]
```

Ahmed2007		
CRECK2012	HCO + HO2 → CO2 + H + OH	H2O2 + O → HO2 + OH
Dagaut2003		
Davis2005		
gri30		
Keromnes2013	2 HCO → 2 CO + H2	HCO + HO2 → CO2 + H + OH
Li2007		
NUIG2010		
Rasmussen2008		
SanDiego2011		
SaxenaWilliams2006		
Starik2009		
Sun2007		
USC2007		
Zsely2005		

```
coevery[[2, 2]] /. x_Equilibrium → Sequence[]
```

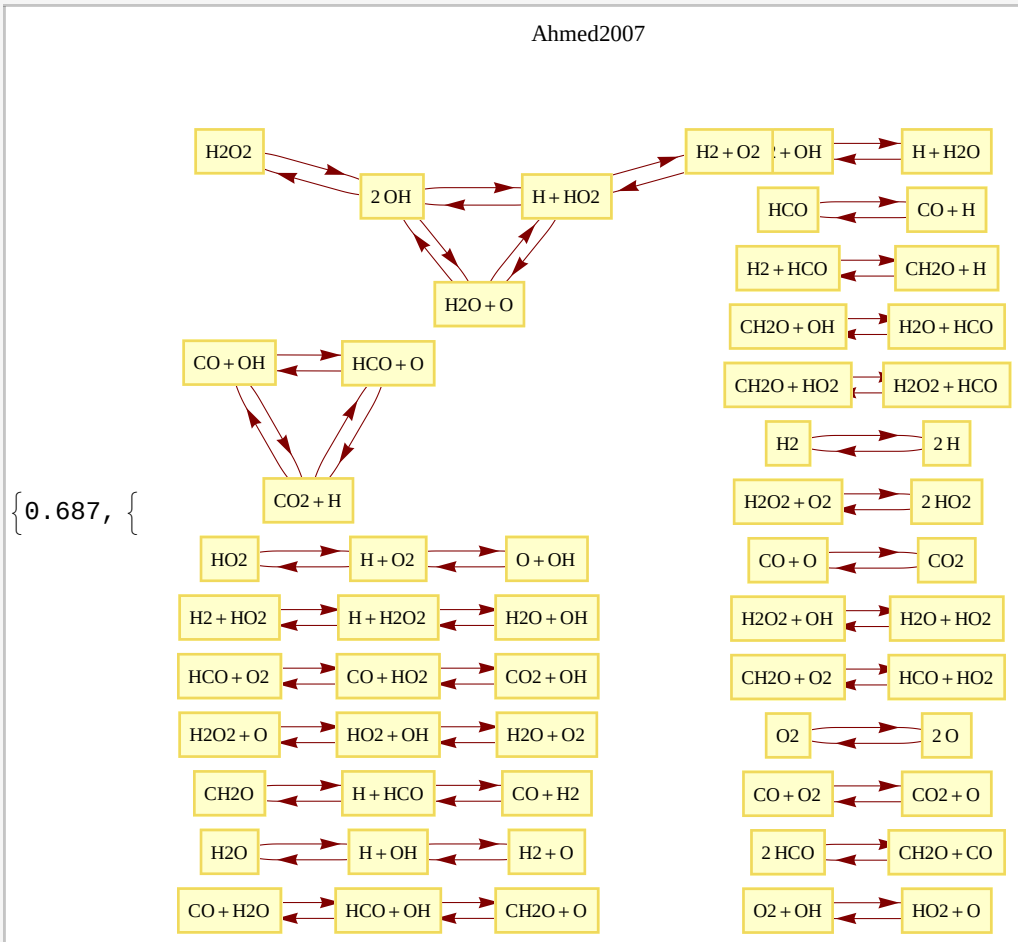
{HCO + HO2 → CO2 + H + OH, H2O2 + O → HO2 + OH}

```
coevery[[6, 2]] /. x_Equilibrium → Sequence[]
```

{2 HCO → 2 CO + H2, HCO + HO2 → CO2 + H + OH}

```
Row[{ShowFHJGraph[#[[2]], DirectedEdges → True,
      VertexLabeling → All, PlotLabel → #[[3]], ImageSize → 420], "   ",
     Column[Join[{"3rd body species deleted"}, #[[2]]]], "   ", Column[
      Join[{"Orig. Mechanism"}, #[[1]]]]}] & /@ coevery[[indices]] // Timing
```

A very large output was generated. Here is a sample of it:

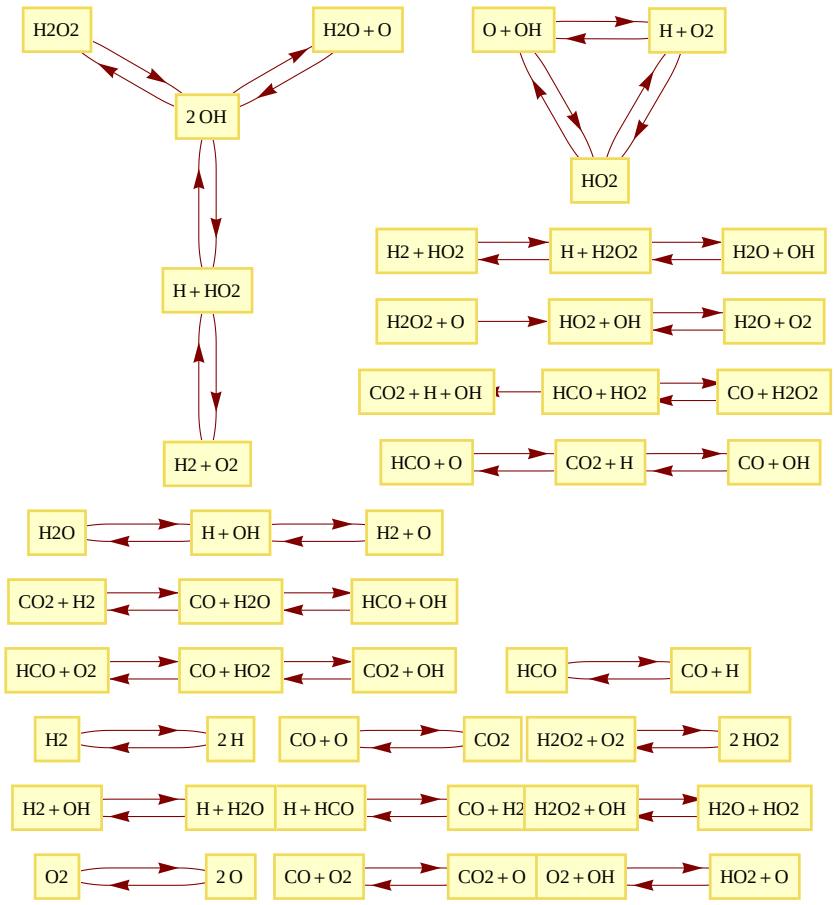


{0.687, {

3rd body species deleted	Orig. Mechanism
CH2O ⇌ H + HCO	H + O2 ⇌ O + OH
CH2O + CO ⇌ 2 HCO	H2 + O ⇌ H + OH
CO2 ⇌ CO + O	H2 + OH ⇌ H + H2O
2 H ⇌ H2	2 OH ⇌ H2O + O
CH2O + H ⇌ H2 + HCO	H + O2 ⇌ HO2
CO + H ⇌ HCO	H + HO2 ⇌ 2 OH
CO2 + H ⇌ HCO + O	H + HO2 ⇌ H2 + O2
CO2 + H ⇌ CO + OH	H + HO2 ⇌ H2O + O
CO + H2 ⇌ H + HCO	HO2 + O ⇌ O2 + OH
H2O ⇌ H + OH	HO2 + OH ⇌ H2O + O2
CO + H2O ⇌ HCO + OH	2 HO2 ⇌ H2O2 + O2
H + H2O ⇌ H2 + OH	2 OH ⇌ H2O2
H2O2 ⇌ 2 OH	H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2 + HO2	H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2O + OH	H2O2 + O ⇌ HO2 + OH
H2O + HCO ⇌ CH2O + OH	H2O2 + OH ⇌ H2O + HO2

H2O2 + HCO ⇌ CH2O + HO2	2 H ⇌ H2
HO2 ⇌ H + O2	H + OH ⇌ H2O
2 HO2 ⇌ H2O2 + O2	2 O ⇌ O2
CO + HO2 ⇌ HCO + O2	CO + OH ⇌ CO2 + H
CO + HO2 ⇌ CO2 + OH	CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O	CO + O ⇌ CO2
H + HO2 ⇌ H2 + O2	CO + O2 ⇌ CO2 + O
H + HO2 ⇌ 2 OH	HCO ⇌ CO + H
H2O + HO2 ⇌ H2O2 + OH	H + HCO ⇌ CO + H2
HCO + HO2 ⇌ CH2O + O2	HCO + O ⇌ CO + OH
2 O ⇌ O2	HCO + O ⇌ CO2 + H
CH2O + O ⇌ HCO + OH	HCO + OH ⇌ CO + H2O
CO2 + O ⇌ CO + O2	HCO + O2 ⇌ CO + HO2
H2 + O ⇌ H + OH	2 HCO ⇌ CH2O + CO
H2O + O ⇌ 2 OH	CH2O ⇌ H + HCO
H2O2 + O ⇌ HO2 + OH	CH2O + H ⇌ H2 + HCO
HCO + O ⇌ CO + OH	CH2O + O ⇌ HCO + OH
HO2 + O ⇌ O2 + OH	CH2O + OH ⇌ H2O + HCO
H + O2 ⇌ O + OH	CH2O + HO2 ⇌ H2O2 + HCO
H2O + O2 ⇌ HO2 + OH	CH2O + O2 ⇌ HCO + HO2

CRECK2012

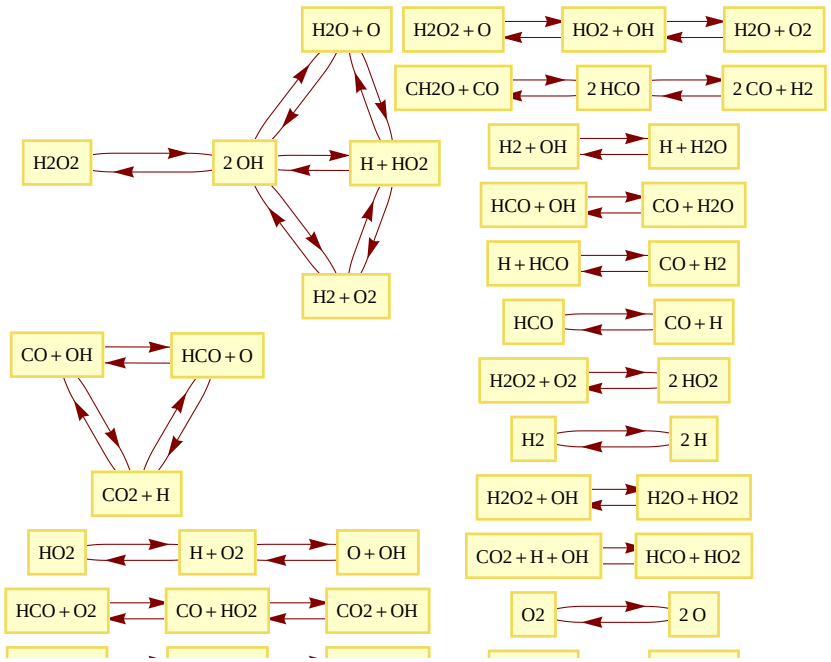


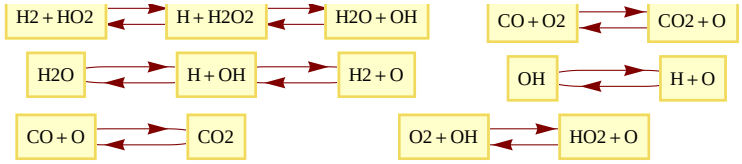
Orig. Mechanism

3rd body species deleted

HCO + HO2 → CO2 + H + OH
H2O2 + O → HO2 + OH
CO2 ⇌ CO + O
2 H ⇌ H2
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
CO2 + H2 ⇌ CO + H2O
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
CO + H2O2 ⇌ HCO + HO2
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
HO2 ⇌ O + OH
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
CO2 + O ⇌ CO + O2
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H + O2 ⇌ HO2
H + 2 O2 ⇌ HO2 + O2
HO2 + OH ⇌ H2O + O2
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH
2 OH ⇌ H2O + O
H2 ⇌ 2 H
O2 ⇌ 2 O
H + OH ⇌ H2O
H + HO2 ⇌ H2 + O2
2 HO2 ⇌ H2O2 + O2
2 OH ⇌ H2O2
O + OH ⇌ HO2
CO + O2 ⇌ CO2 + O
HCO + O2 ⇌ CO + HO2
CO + O ⇌ CO2
CO + OH ⇌ CO2 + H
CO + HO2 ⇌ CO2 + OH
CO + H2O ⇌ CO2 + H2
HCO ⇌ CO + H
HCO + O ⇌ CO2 + H
H + HCO ⇌ CO + H2
HCO + OH ⇌ CO + H2O
HCO + HO2 ⇌ CO + H2O2
HCO + HO2 → CO2 + H + OH
H + H2O ⇌ H2 + OH
H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2 + HO2
H2O + HO2 → H2O2 + OH
H2O2 + OH → H2O + HO2
H2O2 + O → HO2 + OH

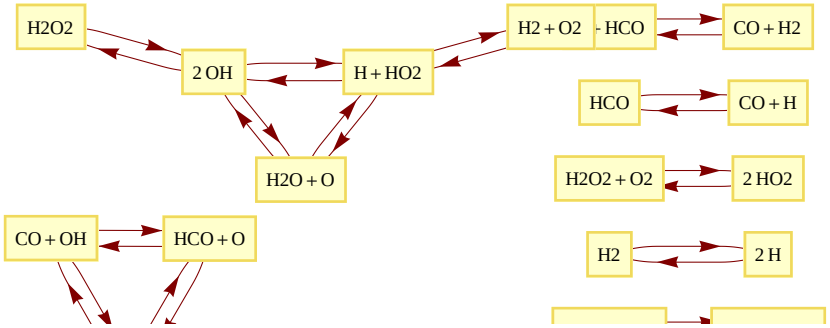
Dagaut2003

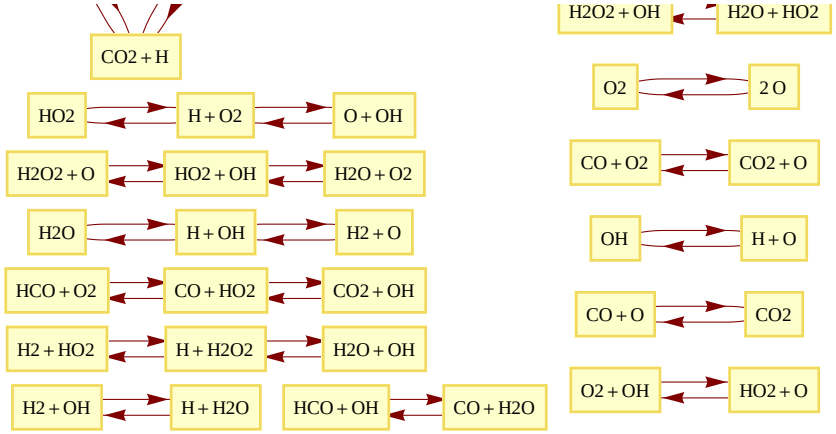




3rd body species deleted	Orig. Mechanism
CH2O + CO ⇌ 2 HCO	2 H ⇌ H2
CO2 ⇌ CO + O	2 O ⇌ O2
2 H ⇌ H2	H + O ⇌ OH
CO + H ⇌ HCO	H2 + O2 ⇌ 2 OH
CO2 + H ⇌ HCO + O	H2 + O ⇌ H + OH
CO2 + H ⇌ CO + OH	H + O2 ⇌ O + OH
CO + H2 ⇌ H + HCO	H + O2 ⇌ HO2
2 CO + H2 ⇌ 2 HCO	H + OH ⇌ H2O
H2O ⇌ H + OH	H2 + OH ⇌ H + H2O
CO + H2O ⇌ HCO + OH	H2O + O ⇌ 2 OH
H + H2O ⇌ H2 + OH	HO2 + OH ⇌ H2O + O2
H2O2 ⇌ 2 OH	HO2 + O ⇌ O2 + OH
H + H2O2 ⇌ H2 + HO2	H + HO2 ⇌ H2 + O2
H + H2O2 ⇌ H2O + OH	H + HO2 ⇌ 2 OH
HO2 ⇌ H + O2	H + HO2 ⇌ H2O + O
2 HO2 ⇌ H2O2 + O2	2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2	2 OH ⇌ H2O2 ,
CO + HO2 ⇌ CO2 + OH	H2O2 + OH ⇌ H2O + HO2
H + HO2 ⇌ H2O + O	H + H2O2 ⇌ H2 + HO2
H + HO2 ⇌ H2 + O2	H + H2O2 ⇌ H2O + OH
H + HO2 ⇌ 2 OH	H2O2 + O ⇌ HO2 + OH
H2O + HO2 ⇌ H2O2 + OH	CO + HO2 ⇌ CO2 + OH
HCO + HO2 ⇌ CO2 + H + OH	CO + OH ⇌ CO2 + H
2 O ⇌ O2	CO + O ⇌ CO2
CO2 + O ⇌ CO + O2	CO + O2 ⇌ CO2 + O
H + O ⇌ OH	HCO ⇌ CO + H
H2 + O ⇌ H + OH	HCO + OH ⇌ CO + H2O
H2O + O ⇌ 2 OH	HCO + O ⇌ CO + OH
H2O2 + O ⇌ HO2 + OH	HCO + O ⇌ CO2 + H
HCO + O ⇌ CO + OH	H + HCO ⇌ CO + H2
HO2 + O ⇌ O2 + OH	HCO + O2 ⇌ CO + HO2
H + O2 ⇌ O + OH	HCO + HO2 ⇌ CO2 + H + OH
H2 + O2 ⇌ 2 OH	2 HCO ⇌ CH2O + CO
H2O + O2 ⇌ HO2 + OH	2 HCO ⇌ 2 CO + H2

Davis2005





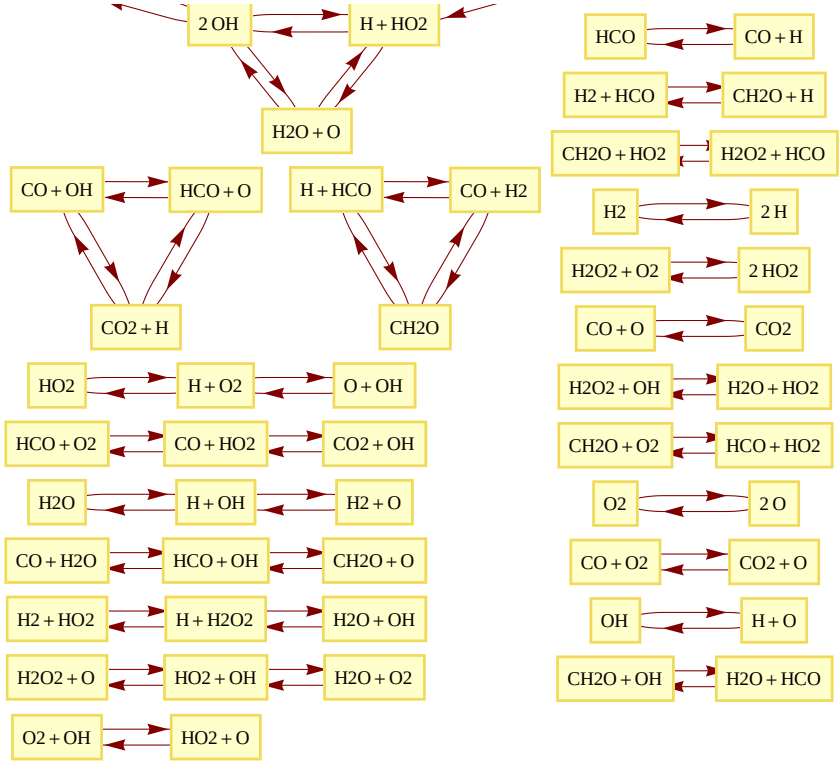
3rd body species deleted

CO2 ⇌ CO + O
2 H ⇌ H2
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O + O
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
2 H + H2O ⇌ H2 + H2O
CO2 + 2 H ⇌ CO2 + H2
H + OH ⇌ H2O
H + O ⇌ OH
2 O ⇌ O2
H + O2 ⇌ HO2
H2 + O2 ⇌ H + HO2
2 OH ⇌ H2O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH ,
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
CO + O ⇌ CO2
CO + OH ⇌ CO2 + H
CO + O2 ⇌ CO2 + O
CO + HO2 ⇌ CO2 + OH
H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
HCO ⇌ CO + H
H2O + HCO ⇌ CO + H + H2O
HCO + O2 ⇌ CO + HO2

gri30



3rd body species deleted

CH2O ⇌ CO + H2
CH2O ⇌ H + HCO
CO2 ⇌ CO + O
2 H ⇌ H2
CH2O + H ⇌ H2 + HCO
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O + HCO ⇌ CH2O + OH
H2O2 + HCO ⇌ CH2O + HO2
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
HCO + HO2 ⇌ CH2O + O2
2 O ⇌ O2

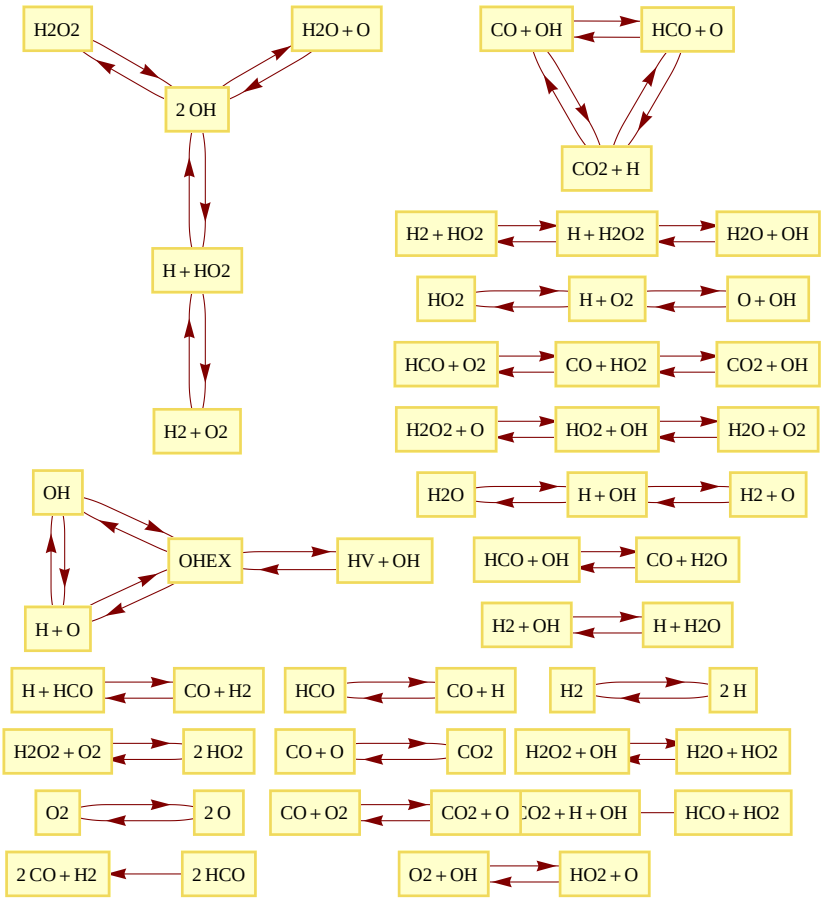
Orig. Mechanism

2 O ⇌ O2
H + O ⇌ OH
H2 + O ⇌ H + OH
HO2 + O ⇌ O2 + OH
H2O2 + O ⇌ HO2 + OH
CO + O ⇌ CO2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
CH2O + O ⇌ HCO + OH
CO + O2 ⇌ CO2 + O
CH2O + O2 ⇌ HCO + HO2
H + O2 ⇌ HO2
H + 2 O2 ⇌ HO2 + O2
H + H2O + O2 ⇌ H2O + HO2
H + N2 + O2 ⇌ HO2 + N2
H + O2 ⇌ O + OH
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
2 H + H2O ⇌ H2 + H2O
CO2 + 2 H ⇌ CO2 + H2
H + OH ⇌ H2O
H + HO2 ⇌ H2O + O ,
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H + HCO ⇌ CH2O
H + HCO ⇌ CO + H2
CH2O + H ⇌ H2 + HCO
CO + H2 ⇌ CH2O

2 O ⇌ O2
CH2O + O ⇌ HCO + OH
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

H2 + OH ⇌ H + H2O
2 OH ⇌ H2O2
2 OH ⇌ H2O + O
HO2 + OH ⇌ H2O + O2
H2O2 + OH ⇌ H2O + HO2
CO + OH ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
CH2O + OH ⇌ H2O + HCO
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ CO2 + OH
CH2O + HO2 ⇌ H2O2 + HCO
H2O + HCO ⇌ CO + H + H2O
HCO ⇌ CO + H
HCO + O2 ⇌ CO + HO2

Keromnes2013



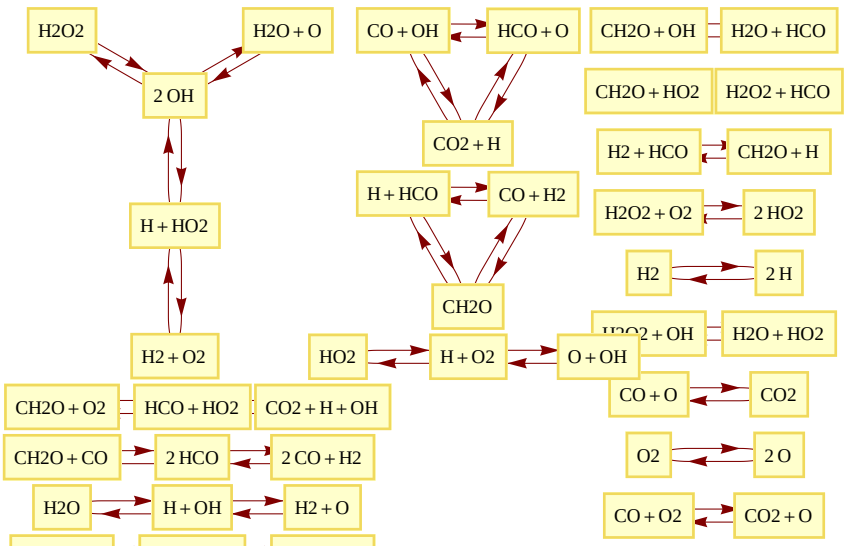
3rd body species deleted
2 HCO → 2 CO + H2

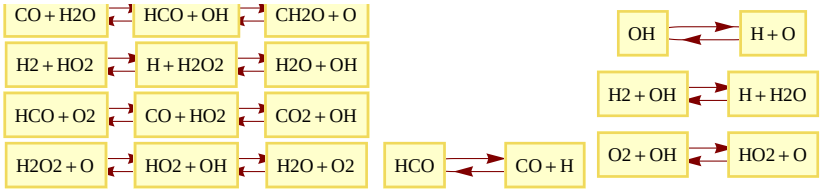
Orig. Mechanism
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
H2O + O ⇌ 2 OH
H2 ⇌ 2 H
2 O ⇌ O2

HCO + HO2 → CO2 + H + OH
CO2 ⇌ CO + O
2 H ⇌ H2
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H + O ⇌ OHEX
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH
OH ⇌ OHEX
HV + OH ⇌ OHEX

H + O ⇌ OH
H + OH ⇌ H2O
H + O2 ⇌ HO2
H + HO2 ⇌ 2 OH
H2 + O2 ⇌ H + HO2
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2 + HO2
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
CO + O ⇌ CO2
CO + O2 ⇌ CO2 + O
CO + OH ⇌ CO2 + H
CO + HO2 ⇌ CO2 + OH
HCO ⇌ CO + H
HCO + O2 ⇌ CO + HO2
H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
HCO + HO2 → CO2 + H + OH
2 HCO → 2 CO + H2
H + O ⇌ OHEX
H2O + OHEX ⇌ H2O + OH
H2 + OHEX ⇌ H2 + OH
N2 + OHEX ⇌ N2 + OH
OH + OHEX ⇌ 2 OH
H + OHEX ⇌ H + OH
OHEX ⇌ OH
OHEX ⇌ HV + OH
O2 + OHEX ⇌ O2 + OH
CO2 + OHEX ⇌ CO2 + OH
CO + OHEX ⇌ CO + OH
CH4 + OHEX ⇌ CH4 + OH

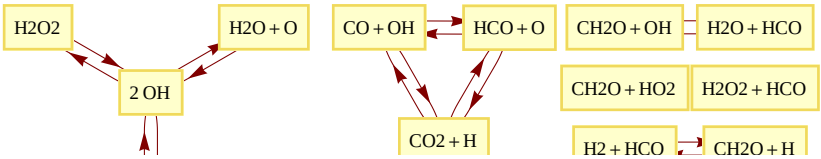
Li2007

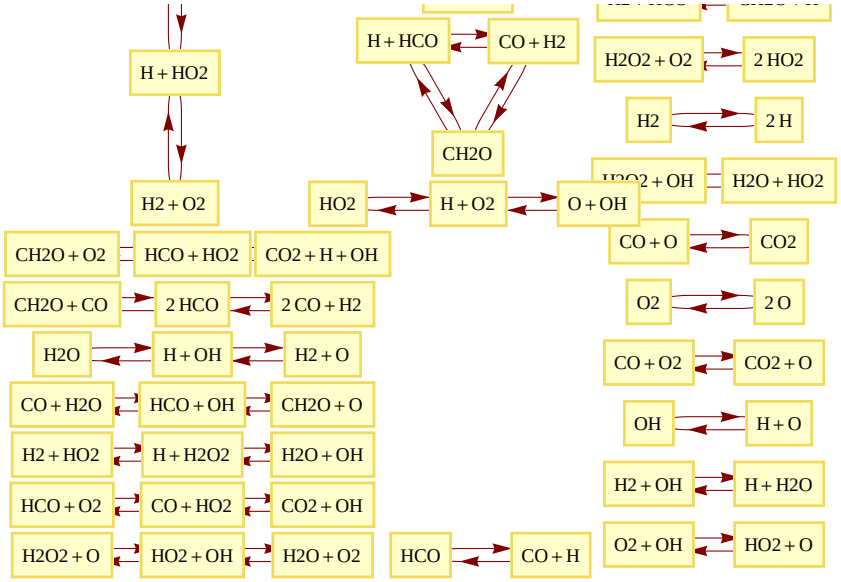




3rd body species deleted	Orig. Mechanism
CH2O ⇌ CO + H2	H + O2 ⇌ O + OH
CH2O ⇌ H + HCO	H2 + O ⇌ H + OH
CH2O + CO ⇌ 2 HCO	H2 + OH ⇌ H + H2O
CO2 ⇌ CO + O	H2O + O ⇌ 2 OH
2 H ⇌ H2	H2 ⇌ 2 H
CH2O + H ⇌ H2 + HCO	2 O ⇌ O2
CO + H ⇌ HCO	H + O ⇌ OH
CO2 + H ⇌ HCO + O	H + OH ⇌ H2O
CO2 + H ⇌ CO + OH	H + O2 ⇌ HO2
CO + H2 ⇌ H + HCO	H + HO2 ⇌ H2 + O2
2 CO + H2 ⇌ 2 HCO	H + HO2 ⇌ 2 OH
H2O ⇌ H + OH	HO2 + O ⇌ O2 + OH
CO + H2O ⇌ HCO + OH	HO2 + OH ⇌ H2O + O2
H + H2O ⇌ H2 + OH	2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH	H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2O + OH	H + H2O2 ⇌ H2 + HO2
H2O + HCO ⇌ CH2O + OH	H2O2 + O ⇌ HO2 + OH
H2O2 + HCO ⇌ CH2O + HO2	H2O2 + OH ⇌ H2O + HO2
HO2 ⇌ H + O2	CO + O ⇌ CO2
2 HO2 ⇌ H2O2 + O2	CO + O2 ⇌ CO2 + O
CO + HO2 ⇌ HCO + O2	CO + HO2 ⇌ CO2 + OH
CO + HO2 ⇌ CO2 + OH	CO + OH ⇌ CO2 + H
H + HO2 ⇌ H2 + O2	HCO ⇌ CO + H
H + HO2 ⇌ 2 OH	HCO + O2 ⇌ CO + HO2
H2O + HO2 ⇌ H2O2 + OH	H + HCO ⇌ CO + H2
HCO + HO2 ⇌ CH2O + O2	HCO + O ⇌ CO + OH
HCO + HO2 ⇌ CO2 + H + OH	HCO + OH ⇌ CO + H2O
2 O ⇌ O2	HCO + O ⇌ CO2 + H
CH2O + O ⇌ HCO + OH	HCO + HO2 ⇌ CO2 + H + OH
CO2 + O ⇌ CO + O2	2 HCO ⇌ 2 CO + H2
H + O ⇌ OH	2 HCO ⇌ CH2O + CO
H2 + O ⇌ H + OH	CH2O ⇌ H + HCO
H2O + O ⇌ 2 OH	CH2O ⇌ CO + H2
H2O2 + O ⇌ HO2 + OH	CH2O + H ⇌ H2 + HCO
HCO + O ⇌ CO + OH	CH2O + O ⇌ HCO + OH
HO2 + O ⇌ O2 + OH	CH2O + OH ⇌ H2O + HCO
H + O2 ⇌ O + OH	CH2O + O2 ⇌ HCO + HO2
H2O + O2 ⇌ HO2 + OH	CH2O + HO2 ⇌ H2O2 + HCO

NUIG2010



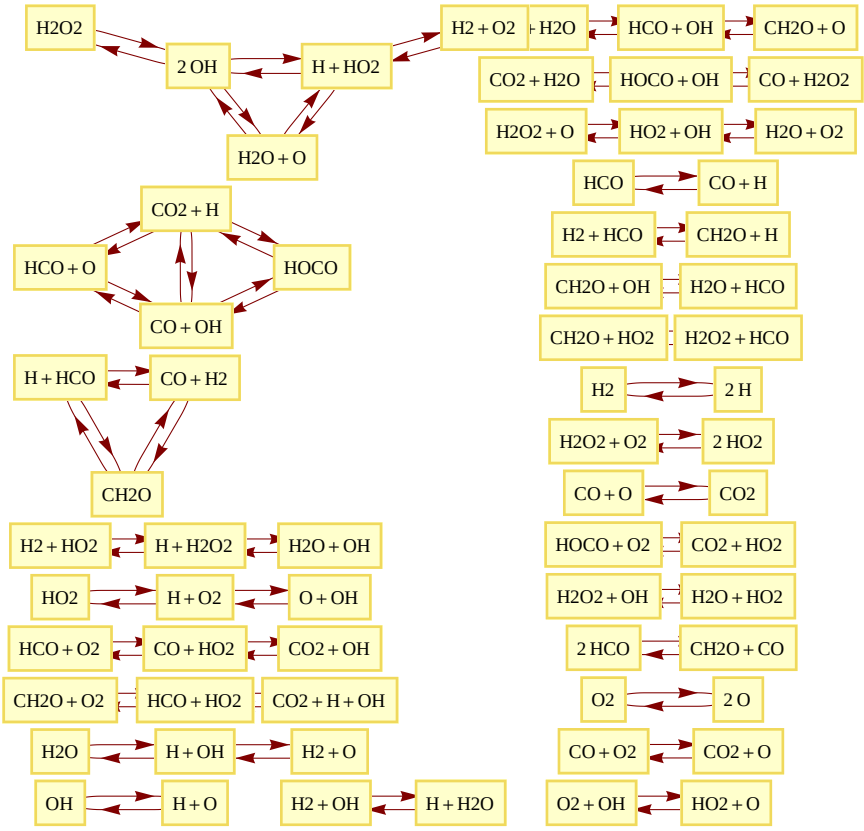


3rd body species deleted	Orig. Mechanism
CH2O ⇌ CO + H2	H + O2 ⇌ O + OH
CH2O ⇌ H + HCO	H2 + O ⇌ H + OH
CH2O + CO ⇌ 2 HCO	H2 + OH ⇌ H + H2O
CO2 ⇌ CO + O	H2O + O ⇌ 2 OH
2 H ⇌ H2	H2 ⇌ 2 H
CH2O + H ⇌ H2 + HCO	O2 ⇌ 2 O
CO + H ⇌ HCO	OH ⇌ H + O
CO2 + H ⇌ HCO + O	H2O ⇌ H + OH
CO2 + H ⇌ CO + OH	H + O2 ⇌ HO2
CO + H2 ⇌ H + HCO	H + HO2 ⇌ H2 + O2
2 CO + H2 ⇌ 2 HCO	H + HO2 ⇌ 2 OH
H2O ⇌ H + OH	HO2 + O ⇌ O2 + OH
CO + H2O ⇌ HCO + OH	HO2 + OH ⇌ H2O + O2
H + H2O ⇌ H2 + OH	H2O2 + O2 ⇌ 2 HO2
H2O2 ⇌ 2 OH	H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2	H + H2O2 ⇌ H2O + OH
H + H2O2 ⇌ H2O + OH	H + H2O2 ⇌ H2 + HO2
H2O + HCO ⇌ CH2O + OH	H2O2 + O ⇌ HO2 + OH
H2O2 + HCO ⇌ CH2O + HO2	H2O2 + OH ⇌ H2O + HO2
HO2 ⇌ H + O2	CO + O ⇌ CO2 '
2 HO2 ⇌ H2O2 + O2	CO + O2 ⇌ CO2 + O
CO + HO2 ⇌ HCO + O2	CO + OH ⇌ CO2 + H
CO + HO2 ⇌ CO2 + OH	CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2 + O2	HCO ⇌ CO + H
H + HO2 ⇌ 2 OH	HCO + O2 ⇌ CO + HO2
H2O + HO2 ⇌ H2O2 + OH	H + HCO ⇌ CO + H2
HCO + HO2 ⇌ CH2O + O2	HCO + O ⇌ CO + OH
HCO + HO2 ⇌ CO2 + H + OH	HCO + O ⇌ CO2 + H
2 O ⇌ O2	HCO + OH ⇌ CO + H2O
CH2O + O ⇌ HCO + OH	HCO + HO2 ⇌ CH2O + O2
CO2 + O ⇌ CO + O2	HCO + HO2 ⇌ CO2 + H + OH
H + O ⇌ OH	CH2O + CO ⇌ 2 HCO
H2 + O ⇌ H + OH	2 HCO ⇌ 2 CO + H2
H2O + O ⇌ 2 OH	H + HCO ⇌ CH2O
H2O2 + O ⇌ HO2 + OH	CO + H2 ⇌ CH2O
HCO + O ⇌ CO + OH	CH2O + OH ⇌ H2O + HCO

HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

CH2O + H ⇌ H2 + HCO
CH2O + O ⇌ HCO + OH
CH2O + HO2 ⇌ H2O2 + HCO

Rasmussen2008



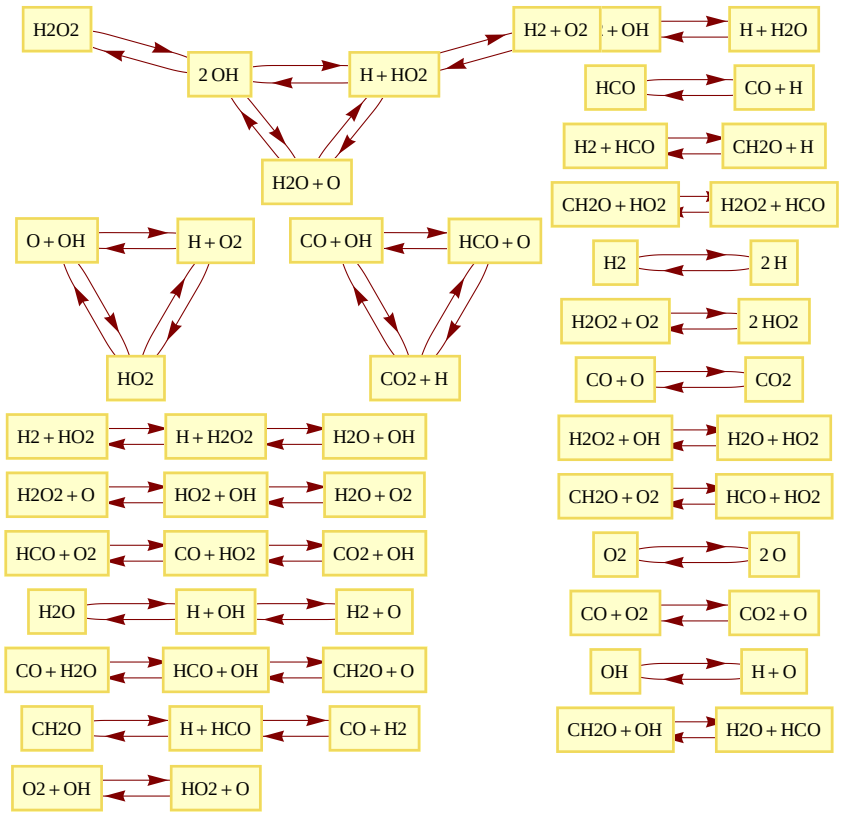
3rd body species deleted
CH2O ⇌ CO + H2
CH2O ⇌ H + HCO
CH2O + CO ⇌ 2 HCO
CO2 ⇌ CO + O
2 H ⇌ H2
CH2O + H ⇌ H2 + HCO
CO + H ⇌ HCO
CO2 + H ⇌ HOCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
CO2 + H2O ⇌ HOCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
CO + H2O2 ⇌ HOCO + OH
H + H2O2 ⇌ H2 + HO2

Orig. Mechanism
H + O2 ⇌ O + OH
2 H ⇌ H2
2 H + N2 ⇌ H2 + N2
2 H + H2 ⇌ 2 H2
2 H + H2O ⇌ H2 + H2O
H + O ⇌ OH
H + O2 ⇌ HO2
2 O ⇌ O2
H2 + O ⇌ H + OH
2 OH ⇌ H2O + O
H + OH ⇌ H2O
H2 + OH ⇌ H + H2O
H2 + O2 ⇌ H + HO2
H + HO2 ⇌ 2 OH
H + HO2 ⇌ H2O + O
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2O + OH

H + H2O2 ⇌ H2O + OH
H2O + HCO ⇌ CH2O + OH
H2O2 + HCO ⇌ CH2O + HO2
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
CO2 + HO2 ⇌ HOCO + O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
HCO + HO2 ⇌ CH2O + O2
HCO + HO2 ⇌ CO2 + H + OH
HOCO ⇌ CO + OH
2 O ⇌ O2
CH2O + O ⇌ HCO + OH
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

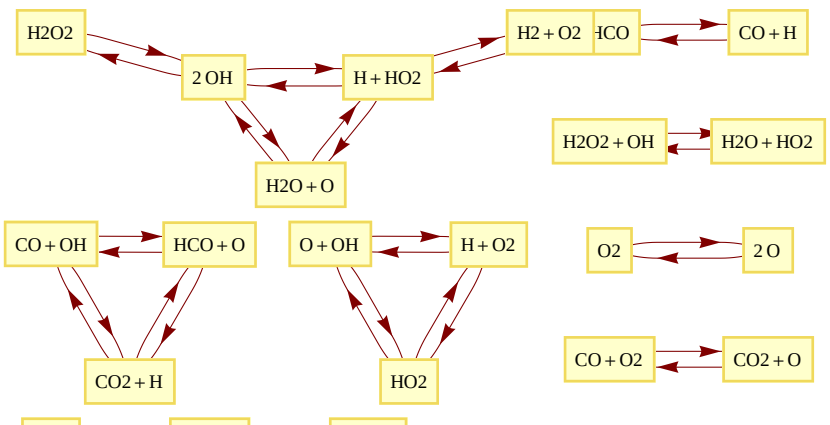
H + H2O2 ⇌ H2 + HO2
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
CO + O ⇌ CO2
CO + O2 ⇌ CO2 + O
CO + HO2 ⇌ CO2 + OH
CO + OH ⇌ CO2 + H
CO + OH ⇌ HOCO
HOCO ⇌ CO2 + H
HOCO + OH ⇌ CO2 + H2O
HOCO + OH ⇌ CO + H2O2
HOCO + O2 ⇌ CO2 + HO2
HCO ⇌ CO + H
H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
HCO + O2 ⇌ CO + HO2
HCO + HO2 ⇌ CO2 + H + OH
2 HCO ⇌ CH2O + CO
CH2O ⇌ H + HCO
CH2O ⇌ CO + H2
CH2O + H ⇌ H2 + HCO
CH2O + O ⇌ HCO + OH
CH2O + O2 ⇌ HCO + HO2
CH2O + OH ⇌ H2O + HCO
CH2O + HO2 ⇌ H2O2 + HCO

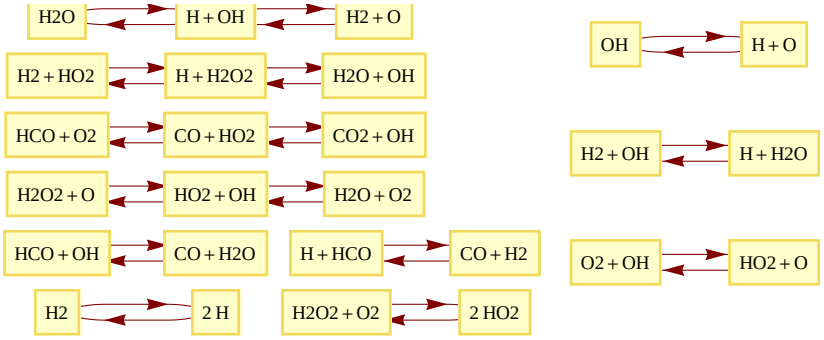
SanDiego2011



3rd body species deleted	Orig. Mechanism
CH2O ⇌ H + HCO	H + O2 ⇌ O + OH
CO2 ⇌ CO + O	H2 + O ⇌ H + OH
2 H ⇌ H2	H2 + OH ⇌ H + H2O
CH2O + H ⇌ H2 + HCO	H2O + O ⇌ 2 OH
CO + H ⇌ HCO	2 H ⇌ H2
CO2 + H ⇌ HCO + O	H + OH ⇌ H2O
CO2 + H ⇌ CO + OH	2 O ⇌ O2
CO + H2 ⇌ H + HCO	H + O ⇌ OH
H2O ⇌ H + OH	O + OH ⇌ HO2
CO + H2O ⇌ HCO + OH	H + O2 ⇌ HO2
H + H2O ⇌ H2 + OH	H + HO2 ⇌ 2 OH
H2O2 ⇌ 2 OH	H + HO2 ⇌ H2 + O2
H + H2O2 ⇌ H2 + HO2	H + HO2 ⇌ H2O + O
H + H2O2 ⇌ H2O + OH	HO2 + O ⇌ O2 + OH
H2O + HCO ⇌ CH2O + OH	HO2 + OH ⇌ H2O + O2
H2O2 + HCO ⇌ CH2O + HO2	2 OH ⇌ H2O2
HO2 ⇌ H + O2	2 HO2 ⇌ H2O2 + O2
HO2 ⇌ O + OH	H + H2O2 ⇌ H2 + HO2
2 HO2 ⇌ H2O2 + O2	H + H2O2 ⇌ H2O + OH
CO + HO2 ⇌ HCO + O2	H2O2 + OH ⇌ H2O + HO2
CO + HO2 ⇌ CO2 + OH	H2O2 + O ⇌ HO2 + OH
H + HO2 ⇌ H2O + O	CO + O ⇌ CO2
H + HO2 ⇌ H2 + O2	CO + OH ⇌ CO2 + H
H + HO2 ⇌ 2 OH	CO + HO2 ⇌ CO2 + OH
H2O + HO2 ⇌ H2O2 + OH	CO + O2 ⇌ CO2 + O
HCO + HO2 ⇌ CH2O + O2	HCO ⇌ CO + H
2 O ⇌ O2	H + HCO ⇌ CO + H2
CH2O + O ⇌ HCO + OH	HCO + O ⇌ CO + OH
CO2 + O ⇌ CO + O2	HCO + O ⇌ CO2 + H
H + O ⇌ OH	HCO + OH ⇌ CO + H2O
H2 + O ⇌ H + OH	HCO + O2 ⇌ CO + HO2
H2O + O ⇌ 2 OH	H + HCO ⇌ CH2O
H2O2 + O ⇌ HO2 + OH	CH2O + H ⇌ H2 + HCO
HCO + O ⇌ CO + OH	CH2O + O ⇌ HCO + OH
HO2 + O ⇌ O2 + OH	CH2O + OH ⇌ H2O + HCO
H + O2 ⇌ O + OH	CH2O + O2 ⇌ HCO + HO2
H2O + O2 ⇌ HO2 + OH	CH2O + HO2 ⇌ H2O2 + HCO

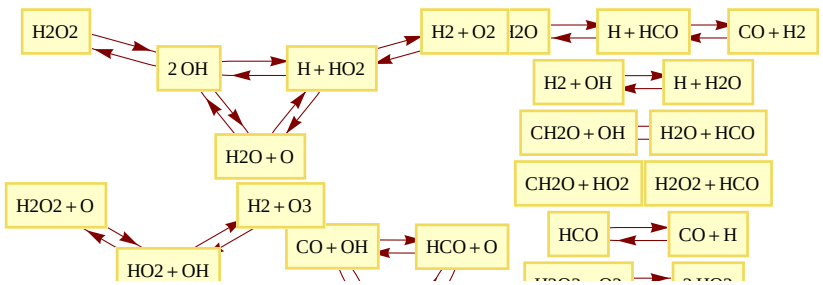
SaxenaWilliams2006

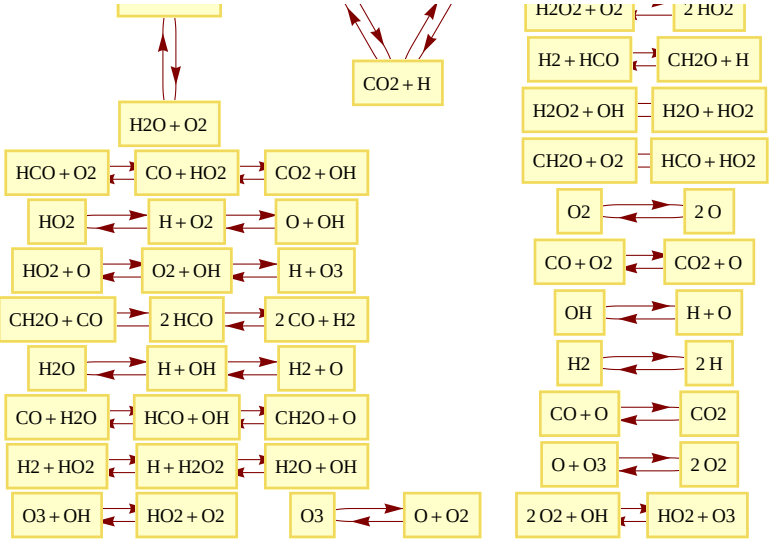




3rd body species deleted	Orig. Mechanism
2 H ⇌ H2	H + O2 ⇌ O + OH
CO + H ⇌ HCO	H2 + O ⇌ H + OH
CO2 + H ⇌ HCO + O	H2 + OH ⇌ H + H2O
CO2 + H ⇌ CO + OH	H2O + O ⇌ 2 OH
CO + H2 ⇌ H + HCO	2 H ⇌ H2
H2O ⇌ H + OH	H + OH ⇌ H2O
CO + H2O ⇌ HCO + OH	2 O ⇌ O2
H + H2O ⇌ H2 + OH	H + O ⇌ OH
H2O2 ⇌ 2 OH	O + OH ⇌ HO2
H + H2O2 ⇌ H2 + HO2	H + O2 ⇌ HO2
H + H2O2 ⇌ H2O + OH	H + HO2 ⇌ 2 OH
HO2 ⇌ H + O2	H + HO2 ⇌ H2 + O2
HO2 ⇌ O + OH	H + HO2 ⇌ H2O + O
2 HO2 ⇌ H2O2 + O2	HO2 + O ⇌ O2 + OH
CO + HO2 ⇌ HCO + O2	HO2 + OH ⇌ H2O + O2 ,
CO + HO2 ⇌ CO2 + OH	2 OH ⇌ H2O2
H + HO2 ⇌ H2O + O	2 HO2 ⇌ H2O2 + O2
H + HO2 ⇌ H2 + O2	H + H2O2 ⇌ H2 + HO2
H + HO2 ⇌ 2 OH	H + H2O2 ⇌ H2O + OH
H2O + HO2 ⇌ H2O2 + OH	H2O2 + OH ⇌ H2O + HO2
2 O ⇌ O2	H2O2 + O ⇌ HO2 + OH
CO2 + O ⇌ CO + O2	CO + OH ⇌ CO2 + H
H + O ⇌ OH	CO + HO2 ⇌ CO2 + OH
H2 + O ⇌ H + OH	CO + O2 ⇌ CO2 + O
H2O + O ⇌ 2 OH	HCO ⇌ CO + H
H2O2 + O ⇌ HO2 + OH	H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH	HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH	HCO + O ⇌ CO2 + H
H + O2 ⇌ O + OH	HCO + OH ⇌ CO + H2O
H2O + O2 ⇌ HO2 + OH	HCO + O2 ⇌ CO + HO2

Starik2009





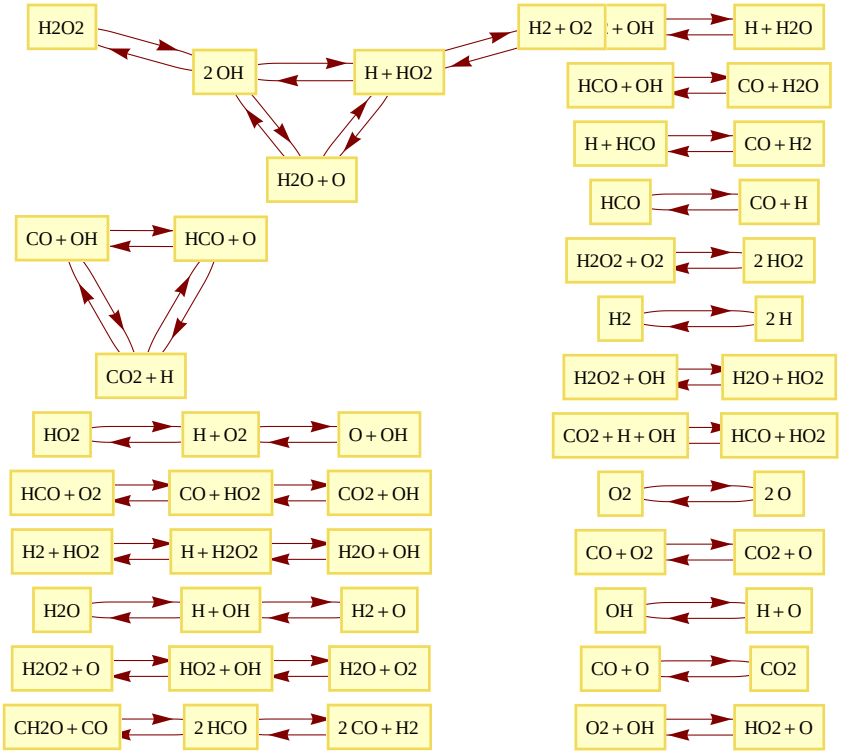

```
3rd body species deleted
CH2O ⇌ H + HCO
CH2O + CO ⇌ 2 HCO
CO2 ⇌ CO + O
2 H ⇌ H2
CH2O + H ⇌ H2 + HCO
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
2 CO + H2 ⇌ 2 HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O + HCO ⇌ CH2O + OH
H2O2 + HCO ⇌ CH2O + HO2
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
HCO + HO2 ⇌ CH2O + O2
2 O ⇌ O2
CH2O + O ⇌ HCO + OH
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
2 O2 ⇌ O + O3
```

```
Orig. Mechanism
H + H2O ⇌ H2 + OH
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
O2 ⇌ 2 O
H2 ⇌ 2 H
H2O ⇌ H + OH
OH ⇌ H + O
H2O + O ⇌ 2 OH
H + O2 ⇌ HO2
H2 + O2 ⇌ H + HO2
H2O + O ⇌ H + HO2
H2O + O2 ⇌ HO2 + OH
2 OH ⇌ H + HO2
O2 + OH ⇌ HO2 + O
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
2 HO2 ⇌ H2O2 + O2
H2O + HO2 ⇌ H2O2 + OH
HO2 + OH ⇌ H2O2 + O
H2O2 ⇌ 2 OH
O3 ⇌ O + O2
H + O3 ⇌ O2 + OH
O + O3 ⇌ 2 O2
O3 + OH ⇌ HO2 + O2
H2 + O3 ⇌ HO2 + OH
HO2 + O3 ⇌ 2 O2 + OH
CO + O2 ⇌ CO2 + O
CO + O ⇌ CO2
CO + OH ⇌ CO2 + H
CO + HO2 ⇌ CO2 + OH
HCO ⇌ CO + H
H2 + HCO ⇌ CH2O + H
CO + HO2 ⇌ HCO + O2
CO + H2 ⇌ H + HCO
HCO + O ⇌ CO2 + H
HCO + O ⇌ CO + OH
HCO + OH ⇌ CO + H2O
```

H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH
HO2 + O2 ⇌ O3 + OH
O + O2 ⇌ O3
H + O3 ⇌ O2 + OH
H2 + O3 ⇌ HO2 + OH
HO2 + O3 ⇌ 2 O2 + OH

2 HCO ⇌ 2 CO + H2
2 HCO ⇌ CH2O + CO
CH2O ⇌ H + HCO
CH2O + O2 ⇌ HCO + HO2
CH2O + O ⇌ HCO + OH
CH2O + OH ⇌ H2O + HCO
CH2O + HO2 ⇌ H2O2 + HCO

Sun2007



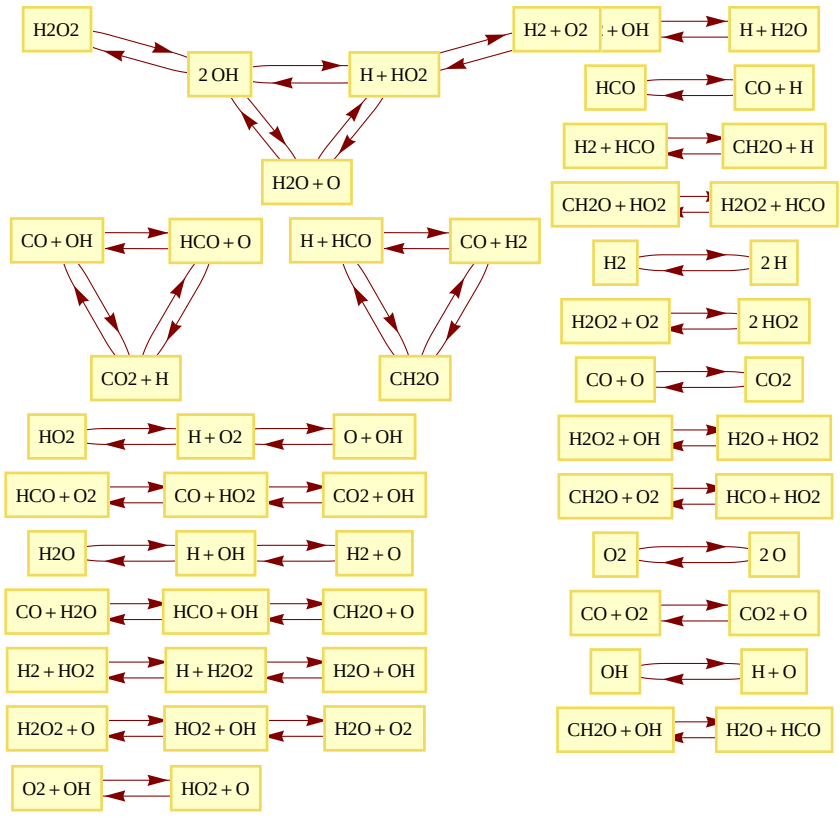
3rd body species deleted
CH2O + CO ⇌ 2 HCO
CO2 ⇌ CO + O
2 H ⇌ H2
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
2 CO + H2 ⇌ 2 HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2

Orig. Mechanism
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O + O
H2 ⇌ 2 H
2 H2 ⇌ 2 H + H2
H2 + N2 ⇌ 2 H + N2
H2 + H2O ⇌ 2 H + H2O
2 O ⇌ O2
H + O ⇌ OH
H + OH ⇌ H2O
H + O2 ⇌ HO2
H2 + O2 ⇌ H + HO2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2O2 ⇌ 2 OH

CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
HCO + HO2 ⇌ CO2 + H + OH
2 O ⇌ O2
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
CO + O ⇌ CO2
CO + O2 ⇌ CO2 + O
CO + HO2 ⇌ CO2 + OH
CO + OH ⇌ CO2 + H
HCO ⇌ CO + H
H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
HCO + HO2 ⇌ CO2 + H + OH
2 HCO ⇌ 2 CO + H2
2 HCO ⇌ CH2O + CO
HCO + O2 ⇌ CO + HO2

USC2007



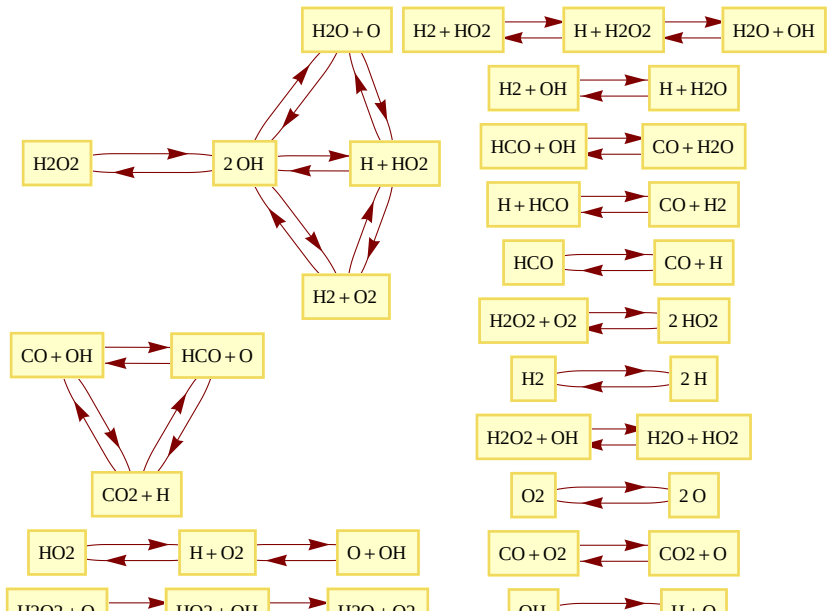
3rd body species deleted
CH2O ⇌ CO + H2
CH2O ⇌ H + HCO
CO2 ⇌ CO + O
2 H ⇌ H2

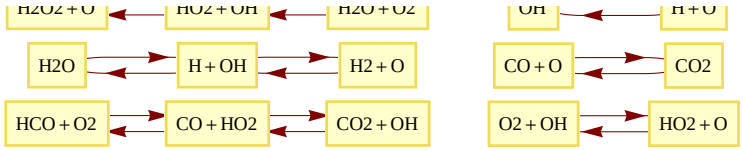
Orig. Mechanism
H + O2 ⇌ O + OH
H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
2 OH ⇌ H2O + O
2 H ⇌ H2
2 H + H2 ⇌ 2 H2

CH2O + H ⇌ H2 + HCO
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O + HCO ⇌ CH2O + OH
H2O2 + HCO ⇌ CH2O + HO2
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
HCO + HO2 ⇌ CH2O + O2
2 O ⇌ O2
CH2O + O ⇌ HCO + OH
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2O + O2 ⇌ HO2 + OH

2 H + H2O ⇌ H2 + H2O
CO2 + 2 H ⇌ CO2 + H2
H + OH ⇌ H2O
H + O ⇌ OH
2 O ⇌ O2
H + O2 ⇌ HO2
H2 + O2 ⇌ H + HO2
2 OH ⇌ H2O2
H + HO2 ⇌ H2O + O
H + HO2 ⇌ 2 OH
HO2 + O ⇌ O2 + OH
2 HO2 ⇌ H2O2 + O2
HO2 + OH ⇌ H2O + O2
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
CO + O ⇌ CO2
CO + OH ⇌ CO2 + H
CO + O2 ⇌ CO2 + O
CO + HO2 ⇌ CO2 + OH
H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
HCO ⇌ CO + H
H2O + HCO ⇌ CO + H + H2O
HCO + O2 ⇌ CO + HO2
CO + H2 ⇌ CH2O
H + HCO ⇌ CH2O
CH2O + H ⇌ H2 + HCO
CH2O + O ⇌ HCO + OH
CH2O + OH ⇌ H2O + HCO
CH2O + O2 ⇌ HCO + HO2
CH2O + HO2 ⇌ H2O2 + HCO

Zsely2005





3rd body species deleted

CO2 ⇌ CO + O
2 H ⇌ H2
CO + H ⇌ HCO
CO2 + H ⇌ HCO + O
CO2 + H ⇌ CO + OH
CO + H2 ⇌ H + HCO
H2O ⇌ H + OH
CO + H2O ⇌ HCO + OH
H + H2O ⇌ H2 + OH
H2O2 ⇌ 2 OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
HO2 ⇌ H + O2
2 HO2 ⇌ H2O2 + O2
CO + HO2 ⇌ HCO + O2
CO + HO2 ⇌ CO2 + OH
H + HO2 ⇌ H2O + O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H2O + HO2 ⇌ H2O2 + OH
2 O ⇌ O2
CO2 + O ⇌ CO + O2
H + O ⇌ OH
H2 + O ⇌ H + OH
H2O + O ⇌ 2 OH
H2O2 + O ⇌ HO2 + OH
HCO + O ⇌ CO + OH
HO2 + O ⇌ O2 + OH
H + O2 ⇌ O + OH
H2 + O2 ⇌ 2 OH
H2O + O2 ⇌ HO2 + OH

Orig. Mechanism

H2 + O ⇌ H + OH
H2 + OH ⇌ H + H2O
H + O2 ⇌ HO2
H + O2 ⇌ O + OH
H + H2O2 ⇌ H2 + HO2
H + H2O2 ⇌ H2O + OH
H2O2 + O ⇌ HO2 + OH
H2O2 + OH ⇌ H2O + HO2
2 OH ⇌ H2O2
2 H ⇌ H2
2 H + H2 ⇌ 2 H2
H + O ⇌ OH
H + OH ⇌ H2O
H + HO2 ⇌ H2 + O2
H + HO2 ⇌ 2 OH
H + HO2 ⇌ H2O + O
2 O ⇌ O2
HO2 + O ⇌ O2 + OH
2 OH ⇌ H2O + O
HO2 + OH ⇌ H2O + O2
2 HO2 ⇌ H2O2 + O2
H2 + O2 ⇌ 2 OH
CO + O2 ⇌ CO2 + O
HCO + O2 ⇌ CO + HO2
CO + O ⇌ CO2
CO + OH ⇌ CO2 + H
CO + HO2 ⇌ CO2 + OH
H + HCO ⇌ CO + H2
HCO + O ⇌ CO + OH
HCO + O ⇌ CO2 + H
HCO + OH ⇌ CO + H2O
HCO ⇌ CO + H

}}

Show Less | Show More | Show Full Output | Set Size Limit...

```
maxfhjcomponents =
  MaxFHJWeaklyConnectedComponents[coevery[[#, 2]] & /@ indices;
```

```
maxfhjedges = Flatten[(First /@ #) & /@ maxfhjcomponents, 1];
```

```
GraphPlot[First[#], VertexLabeling → True, DirectedEdges → True,
   ImageSize → 350, PlotLabel → "Max weakly connected component of mech " <>
     ToString[coevery[[Last[#], 3]] <> "\n"] & /@
 Transpose[{maxfhjedges, indices}]
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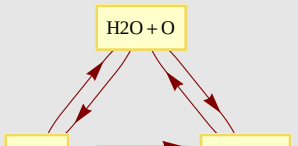
Max weakly connected component of mech Ahmed2007

{



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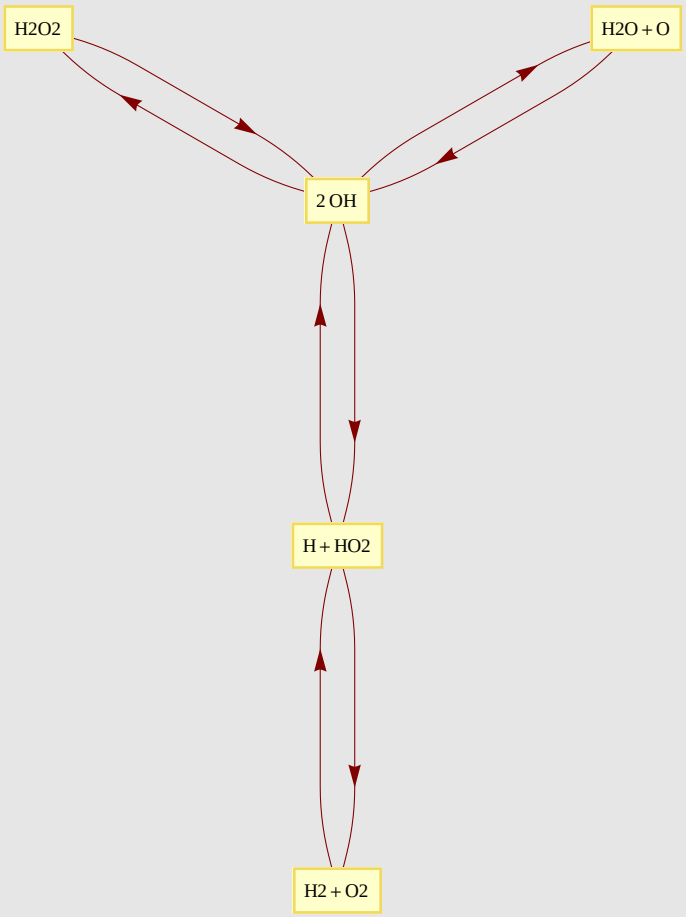
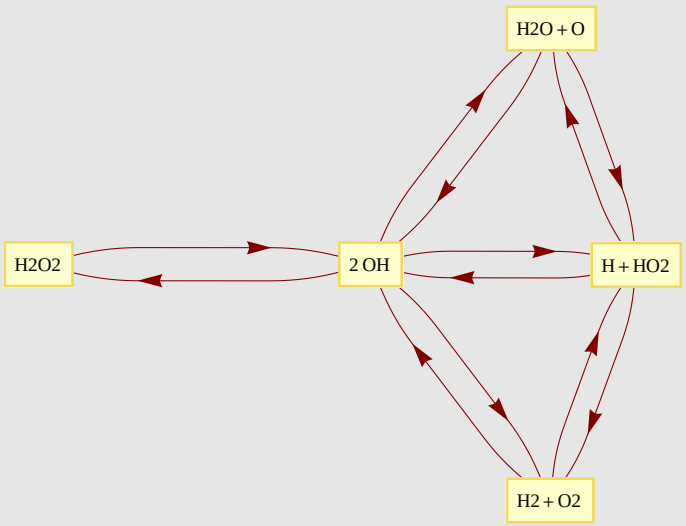
Max weakly connected component of mech CRECK2012



Max weakly connected component of mech Dagaut2003



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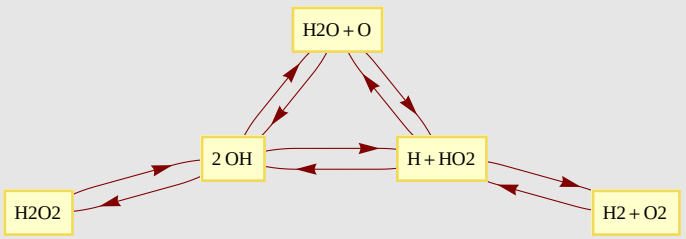
Max weakly connected component of mech Davis2005



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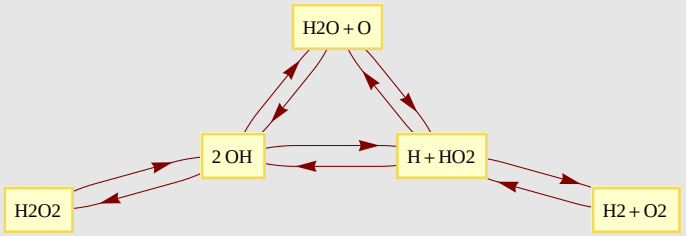
Max weakly connected component of mech gri30



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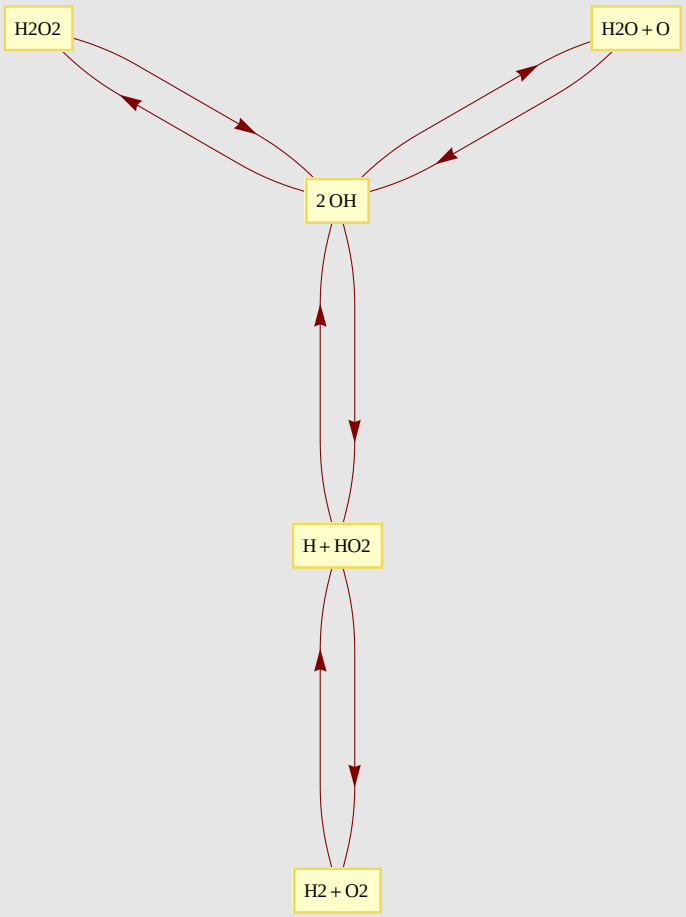
Max weakly connected component of mech Keromnes2013



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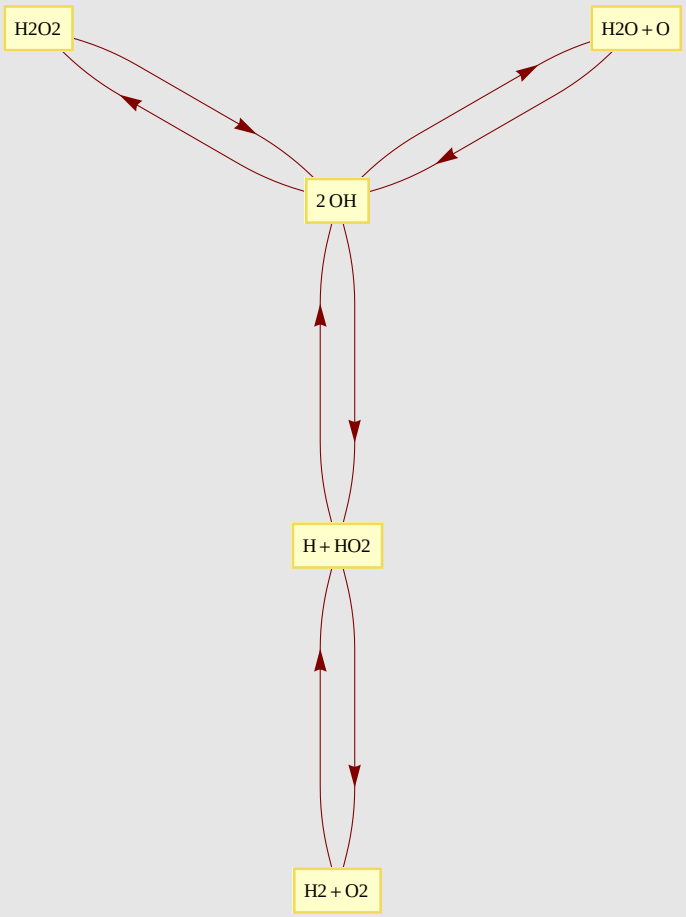
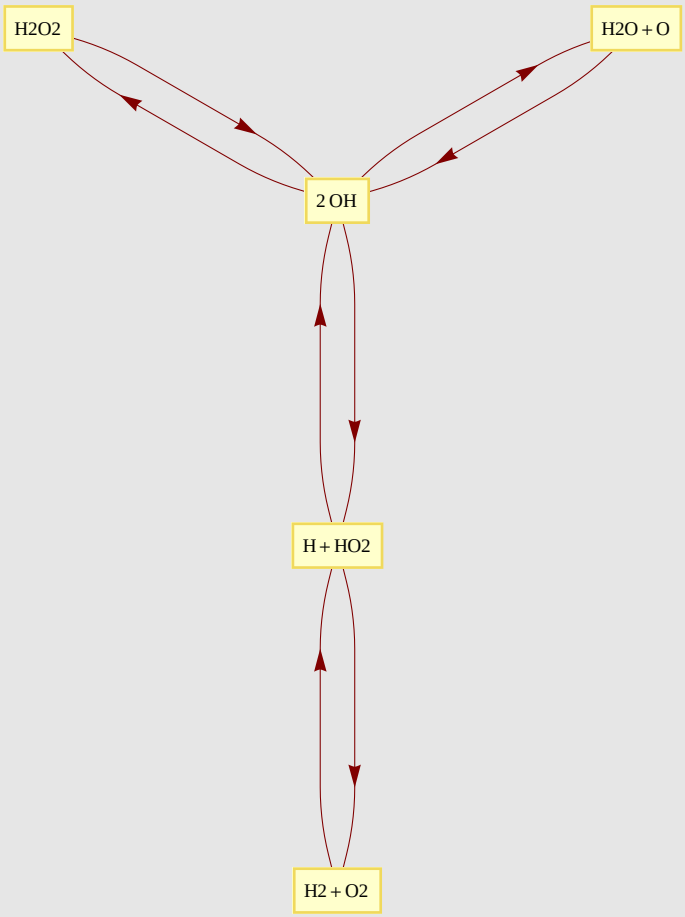
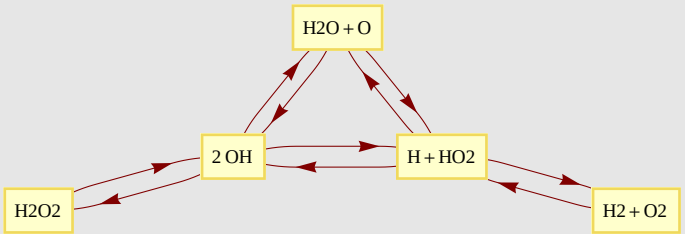
Max weakly connected component of mech Li2007



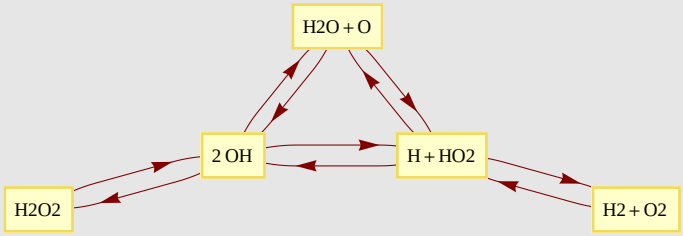
Max weakly connected component of mech NUIG2010



Max weakly connected component of mech Rasmussen2008



Max weakly connected component of mech SanDiego2011



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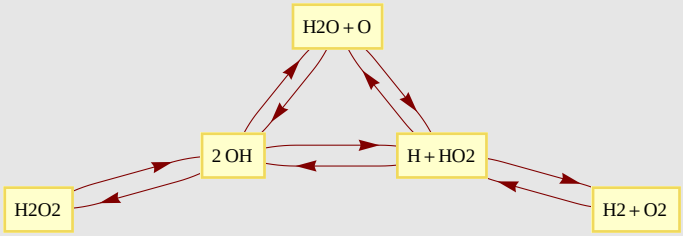
Max weakly connected component of mech SaxenaWilliams2006



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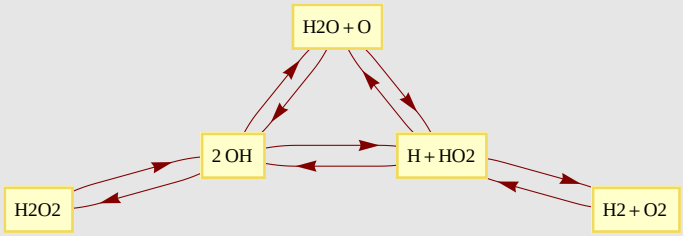
Max weakly connected component of mech Starik2009



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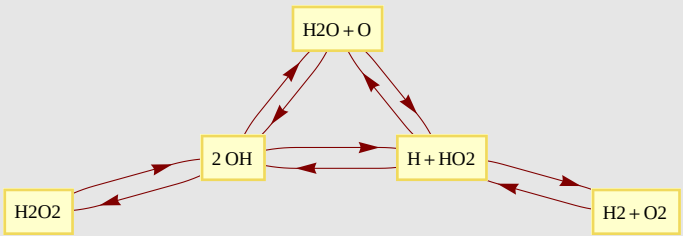
Max weakly connected component of mech Sun2007



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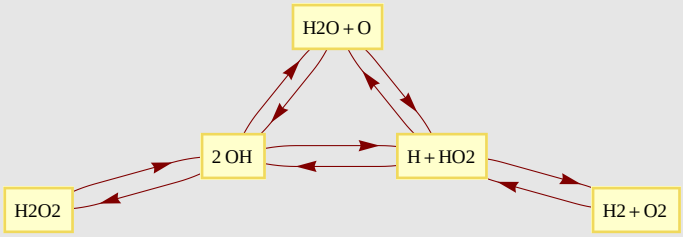
Max weakly connected component of mech USC2007



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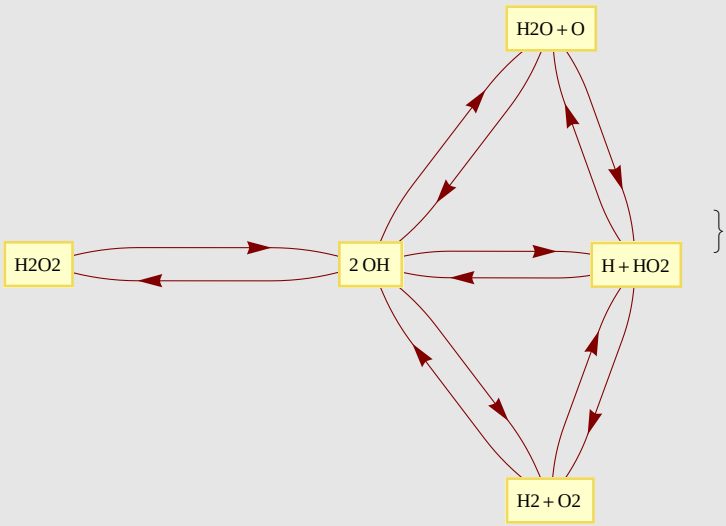
Max weakly connected component of mech Zsely2005

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TableForm[
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    {True → Style["TRUE", Bold]}, {i, 15}, {j, 15}],
 TableHeadings → {codata, codata}]
```

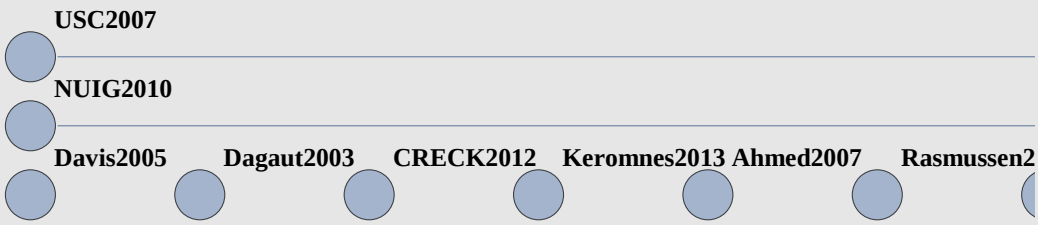
	Ahmed2007	CRECK2012	Dagaut2003	Davis2005	gri3
Ahmed2007	**TRUE**	False	False	False	Fals
CRECK2012	False	**TRUE**	False	False	Fals
Dagaut2003	False	False	**TRUE**	False	Fals
Davis2005	False	False	False	**TRUE**	Fals
gri30	False	False	False	False	**TRUE**
Keromnes2013	False	False	False	False	Fals
Li2007	False	False	False	False	Fals
NUIG2010	False	False	False	False	Fals
Rasmussen2008	False	False	False	False	Fals
SanDiego2011	False	False	False	False	Fals
SaxenaWilliams2006	False	False	False	False	Fals
Starik2009	False	False	False	False	Fals
Sun2007	False	False	False	False	Fals
USC2007	False	False	False	False	**TRUE**
Zsely2005	False	False	False	False	Fals

```
TableForm[
 Table[TrueQ[(coevery[[i, 2]] /. "HV" → 0) == (coevery[[j, 2]] /. "HV" → 0)] /.
   {True → Style["T", Bold, Red], False → Style["F", Bold, Blue]},
  {i, 15}, {j, 15}], TableHeadings → {indices, indices}]
```

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	T	F	F	F	F	F	F	F	F	F	F	F	F	F	F
2	F	T	F	F	F	F	F	F	F	F	F	F	F	F	F
3	F	F	T	F	F	F	F	F	F	F	F	F	F	F	F
4	F	F	F	T	F	F	F	F	F	F	F	F	F	F	F
5	F	F	F	F	T	F	F	F	F	F	F	F	F	T	F
6	F	F	F	F	F	T	F	F	F	F	F	F	F	F	F
7	F	F	F	F	F	F	T	T	F	F	F	F	F	F	F
8	F	F	F	F	F	F	T	T	F	F	F	F	F	F	F
9	F	F	F	F	F	F	F	F	T	F	F	F	F	F	F
10	F	F	F	F	F	F	F	F	F	T	F	F	F	F	F
11	F	F	F	F	F	F	F	F	F	F	T	F	F	F	F
12	F	F	F	F	F	F	F	F	F	F	F	T	F	F	F
13	F	F	F	F	F	F	F	F	F	F	F	F	T	F	F
14	F	F	F	F	T	F	F	F	F	F	F	F	F	T	F
15	F	F	F	F	F	F	F	F	F	F	F	F	F	F	T

```
ag = (tt /. {Style["TRUE", Bold] → 1, False → 0}) - IdentityMatrix[15];
```

```
AdjacencyGraph[ag, ImageSize → 1000, ImagePadding → 50, VertexLabels →
  Thread[Rule[indices, Style[#, Bold, 12] & /@ coevery[[indices, 3]]]]]
```




```
wc = ConnectedComponents[AdjacencyGraph[ag]] /.
   Thread[Rule[indices, coevery[[indices, 3]]]];
```

```
TableForm[wc, TableHeadings → {Range[13], None}]
```

```
1     Ahmed2007
2     CRECK2012
3     Dagaut2003
4     Davis2005
5     gri30                 USC2007
6     Keromnes2013
7     Li2007                NUIG2010
8     Rasmussen2008
9     SanDiego2011
10    SaxenaWilliams2006
11    Starik2009
12    Sun2007
13    Zsely2005
```

```
reducedindices = Sort[First /@ ConnectedComponents[AdjacencyGraph[ag]]]
```

```
{1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 15}
```

```
Column[
 Riffle[Row /@ (Join[{Style[coevery[[#, 3]], Bold, 14], "\t"}, VolpertIndexing[
        coevery[[#, 2]], {"H2", "O2", "CO"}, Verbose → True,
        ExternalSpecies → {"HV"}]] & /@ reducedindices), "\n\n"], 2]
```

Ahmed2007

Species	Indices
O2	0
H2	0
CO	0
HO2	1
O	1
CO2	1

Reaction steps	Indices
CO + O2 → CO2 + O	0
O2 → 2 O	0
H2 + O2 → H + HO2	0
CO + H2 → H + HCO	0
H2 → 2 H	0
H + O2 → O + OH	1
HO2 + O → O2 + OH	1
HCO + O → CO + OH	1
H2 + O → H + OH	1
CO2 + O → CO + O2	1
2 O → O2	1
HCO + HO2 → CH2O + O2	1
H + HO2 → 2 OH	1
H + HO2 → H2 + O2	1
H + HO2 → H2O + O	1
CO + HO2 → CO2 + OH	1
HCO + O2 → CO + HO2	1
CO + HO2 → HCO + O2	1
2 HO2 → H2O2 + O2	1
H + O2 → HO2	1
HO2 → H + O2	1
H2 + HO2 → H + H2O2	1
H + HCO → CO + H2	1
CO2 + H → CO + OH	1
HCO + O → CO2 + H	1
CO2 + H → HCO + O	1
HCO → CO + H	1
CO + H → HCO	1
H2 + HCO → CH2O + H	1
2 H → H2	1
CO + O → CO2	1
CO2 → CO + O	1
2 HCO → CH2O + CO	1
H + HCO → CH2O	1
HO2 + OH → H2O + O2	2
H2O + O2 → HO2 + OH	2

CRECK2012

Species	Indices
O2	0
H2	0
CO	0
O	1
H	1
CO2	1
HO2	1
HCO	1
H2O	2
H2O2	2
OH	2

Reaction steps	Indices
CO + O2 → CO2 + O	0
O2 → 2 O	0
H2 + O2 → H + HO2	0
CO + H2 → H + HCO	0
H2 → 2 H	0
H + O2 → O + OH	1
HO2 + O → O2 + OH	1
H2 + O → H + OH	1
CO2 + O → CO + O2	1
2 O → O2	1
H + HO2 → 2 OH	1
H + HO2 → H2 + O2	1
CO + HO2 → CO2 + OH	1
HCO + O2 → CO + HO2	1
CO + HO2 → HCO + O2	1
2 HO2 → H2O2 + O2	1
HO2 → O + OH	1
H + O2 → HO2	1
HO2 → H + O2	1
H2 + HO2 → H + H2O2	1
HCO + HO2 → CO + H2O2	1
CO2 + H2 → CO + H2O	1
H + HCO → CO + H2	1
CO2 + H → CO + OH	1
HCO + O → CO2 + H	1
CO2 + H → HCO + O	1
HCO → CO + H	1
CO + H → HCO	1
2 H → H2	1
CO + O → CO2	1
CO2 → CO + O	1
HCO + HO2 → CO2 + H + OH	1
HO2 + OH → H2O + O2	2
H2O + O2 → HO2 + OH	2
O + OH → H + O2	2
O2 + OH → HO2 + O	2
2 OH → H2O + O	2
H2O + O → 2 OH	2
H + OH → H2 + O	2
H2O2 + OH → H2O + HO2	2
H2O + HO2 → H2O2 + OH	2
2 OH → H + HO2	2
CO2 + OH → CO + HO2	2
H2O2 + O2 → 2 HO2	2
O + OH → HO2	2
H2O + OH → H + H2O2	2
H + H2O2 → H2O + OH	2
H + H2O2 → H2 + HO2	2
CO + H2O2 → HCO + HO2	2
2 OH → H2O2	2
H2O2 → 2 OH	2
H2 + OH → H + H2O	2
H + H2O → H2 + OH	2
HCO + OH → CO + H2O	2
CO + H2O → HCO + OH	2
H + OH → H2O	2
H2O → H + OH	2
CO + H2O → CO2 + H2	2
CO + OH → CO2 + H	2
H2O2 + O → HO2 + OH	2

Dagaut2003

Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
OH	1
H	1
O	1
CO_2	1
HCO	1
H_2O_2	2
H_2O	2
CH_2O	2

Reaction steps	Indices
$H_2 + O_2 \to 2\,OH$	0
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$2\,CO + H_2 \to 2\,HCO$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$HO_2 + OH \to H_2O + O_2$	1
$2\,OH \to H_2 + O_2$	1
$O + OH \to H + O_2$	1
$H + O_2 \to O + OH$	1
$O_2 + OH \to HO_2 + O$	1
$HO_2 + O \to O_2 + OH$	1
$CO + OH \to HCO + O$	1
$HCO + O \to CO + OH$	1
$HO_2 + OH \to H_2O_2 + O$	1
$2\,OH \to H_2O + O$	1
$H + OH \to H_2 + O$	1
$H_2 + O \to H + OH$	1
$OH \to H + O$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$2\,O \to O_2$	1
$CO_2 + H + OH \to HCO + HO_2$	1
$HCO + HO_2 \to CO_2 + H + OH$	1
$2\,OH \to H + HO_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$CO_2 + OH \to CO + HO_2$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,OH \to H_2O_2$	1
$H_2 + OH \to H + H_2O$	1
$HCO + OH \to CO + H_2O$	1
$H + OH \to H_2O$	1
$2\,HCO \to 2\,CO + H_2$	1
$H + HCO \to CO + H_2$	1
$CO + OH \to CO_2 + H$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$2\,HCO \to CH_2O + CO$	1
$H_2O + O_2 \to HO_2 + OH$	2
$H_2O_2 + O \to HO_2 + OH$	2
$H_2O + O \to 2\,OH$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$H_2O + O \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$H_2O_2 \to 2\,OH$	2

Davis2005

Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
HCO	1
H	1
O	1
CO_2	1
H_2O_2	2
H_2O	2
OH	2

Reaction steps	Indices
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$HCO + O \to CO + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$2\,O \to O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$H + HCO \to CO + H_2$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$CO + OH \to HCO + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2
$H_2O + O \to H + HO_2$	2
$CO_2 + OH \to CO + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + H_2O \to H_2 + OH$	2
$HCO + OH \to CO + H_2O$	2
$CO + H_2O \to HCO + OH$	2
$H + OH \to H_2O$	2
$H_2O \to H + OH$	2
$CO + OH \to CO_2 + H$	2

gri30

Species	Indices
O2	0
H2	0
CO	0
HO2	1
O	1
CO2	1
HCO	1
H	1
CH2O	1
H2O2	2
H2O	2
OH	2

Reaction steps	Indices
$CO + O2 \to CO2 + O$	0
$O2 \to 2\ O$	0
$H2 + O2 \to H + HO2$	0
$CO + H2 \to H + HCO$	0
$H2 \to 2\ H$	0
$CO + H2 \to CH2O$	0
$H + O2 \to O + OH$	1
$HO2 + O \to O2 + OH$	1
$HCO + O \to CO + OH$	1
$H2 + O \to H + OH$	1
$H + O \to OH$	1
$CO2 + O \to CO + O2$	1
$CH2O + O \to HCO + OH$	1
$2\ O \to O2$	1
$CH2O + O2 \to HCO + HO2$	1
$HCO + HO2 \to CH2O + O2$	1
$H + HO2 \to 2\ OH$	1
$H + HO2 \to H2 + O2$	1
$H + HO2 \to H2O + O$	1
$CO + HO2 \to CO2 + OH$	1
$HCO + O2 \to CO + HO2$	1
$CO + HO2 \to HCO + O2$	1
$2\ HO2 \to H2O2 + O2$	1
$H + O2 \to HO2$	1
$HO2 \to H + O2$	1
$CH2O + HO2 \to H2O2 + HCO$	1
$H2 + HO2 \to H + H2O2$	1
$H + HCO \to CO + H2$	1
$CO2 + H \to CO + OH$	1
$HCO + O \to CO2 + H$	1
$CO2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$H2 + HCO \to CH2O + H$	1
$CH2O + H \to H2 + HCO$	1
$2\ H \to H2$	1
$CO + O \to CO2$	1
$CO2 \to CO + O$	1
$H + HCO \to CH2O$	1
$CH2O \to H + HCO$	1
$CH2O \to CO + H2$	1
$HO2 + OH \to H2O + O2$	2
$H2O + O2 \to HO2 + OH$	2
$O + OH \to H + O2$	2
$O2 + OH \to HO2 + O$	2
$CO + OH \to HCO + O$	2
$HO2 + OH \to H2O2 + O$	2
$H2O2 + O \to HO2 + OH$	2
$2\ OH \to H2O + O$	2
$H2O + O \to 2\ OH$	2
$H + OH \to H2 + O$	2
$OH \to H + O$	2
$HCO + OH \to CH2O + O$	2
$H2O2 + OH \to H2O + HO2$	2
$H2O + HO2 \to H2O2 + OH$	2
$2\ OH \to H + HO2$	2
$H2O + O \to H + HO2$	2
$CO2 + OH \to CO + HO2$	2
$H2O2 + O2 \to 2\ HO2$	2
$H2O2 + HCO \to CH2O + HO2$	2
$CH2O + OH \to H2O + HCO$	2
$H2O + HCO \to CH2O + OH$	2
$H2O + OH \to H + H2O2$	2
$H + H2O2 \to H2O + OH$	2

Keromnes2013

Species	Indices
O2	0
H2	0
CO	0
O	1
H	1
CO2	1
HO2	1
HCO	1
OHEX	2
H2O2	2
OH	2
H2O	3

Reaction steps	Indices
CO + O2 → CO2 + O	0
O2 → 2 O	0
H2 + O2 → H + HO2	0
CO + H2 → H + HCO	0
H2 → 2 H	0
H + O2 → O + OH	1
HO2 + O → O2 + OH	1
HCO + O → CO + OH	1
H2 + O → H + OH	1
H + O → OHEX	1
H + O → OH	1
CO2 + O → CO + O2	1
2 O → O2	1
H + HO2 → 2 OH	1
H + HO2 → H2 + O2	1
CO + HO2 → CO2 + OH	1
HCO + O2 → CO + HO2	1
CO + HO2 → HCO + O2	1
2 HO2 → H2O2 + O2	1
H + O2 → HO2	1
HO2 → H + O2	1
H2 + HO2 → H + H2O2	1
H + HCO → CO + H2	1
CO2 + H → CO + OH	1
HCO + O → CO2 + H	1
CO2 + H → HCO + O	1
HCO → CO + H	1
CO + H → HCO	1
2 H → H2	1
CO + O → CO2	1
CO2 → CO + O	1
HCO + HO2 → CO2 + H + OH	1
2 HCO → 2 CO + H2	1
OHEX → OH	2
OH → OHEX	2
HO2 + OH → H2O + O2	2
O + OH → H + O2	2
O2 + OH → HO2 + O	2
CO + OH → HCO + O	2
HO2 + OH → H2O2 + O	2
H2O2 + O → HO2 + OH	2
2 OH → H2O + O	2
H + OH → H2 + O	2
OHEX → H + O	2
OH → H + O	2
H2O2 + OH → H2O + HO2	2
2 OH → H + HO2	2
CO2 + OH → CO + HO2	2
H2O2 + O2 → 2 HO2	2
H + H2O2 → H2O + OH	2
H + H2O2 → H2 + HO2	2
2 OH → H2O2	2
H2O2 → 2 OH	2
H2 + OH → H + H2O	2
HCO + OH → CO + H2O	2
H + OH → H2O	2
CO + OH → CO2 + H	2
H2O + O2 → HO2 + OH	3
H2O + O → 2 OH	3
H2O + HO2 → H2O2 + OH	3
H2O + OH → H + H2O2	3
H + H2O → H2 + OH	3
CO + H2O → HCO + OH	3
H2O → H + OH	3

Li2007

Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
O	1
CO_2	1
HCO	1
H	1
CH_2O	1
H_2O_2	2
OH	2
H_2O	3

Reaction steps	Indices
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$2\,CO + H_2 \to 2\,HCO$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$CO + H_2 \to CH_2O$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$HCO + O \to CO + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$CH_2O + O \to HCO + OH$	1
$2\,O \to O_2$	1
$HCO + HO_2 \to CO_2 + H + OH$	1
$CH_2O + O_2 \to HCO + HO_2$	1
$HCO + HO_2 \to CH_2O + O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$CH_2O + HO_2 \to H_2O_2 + HCO$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,HCO \to 2\,CO + H_2$	1
$H + HCO \to CO + H_2$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$H_2 + HCO \to CH_2O + H$	1
$CH_2O + H \to H_2 + HCO$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$2\,HCO \to CH_2O + CO$	1
$CH_2O + CO \to 2\,HCO$	1
$H + HCO \to CH_2O$	1
$CH_2O \to H + HCO$	1
$CH_2O \to CO + H_2$	1
$HO_2 + OH \to H_2O + O_2$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$CO + OH \to HCO + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$HCO + OH \to CH_2O + O$	2
$CO_2 + H + OH \to HCO + HO_2$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$2\,OH \to H + HO_2$	2
$CO_2 + OH \to CO + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O_2 + HCO \to CH_2O + HO_2$	2
$CH_2O + OH \to H_2O + HCO$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2

Rasmussen2008

Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
O	1
CO_2	1
HCO	1
H	1
CH_2O	1
H_2O_2	2
H_2O	2
OH	2
$HOCO$	2

Reaction steps	Indices
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$CO + H_2 \to CH_2O$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$HCO + O \to CO + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$CH_2O + O \to HCO + OH$	1
$2\,O \to O_2$	1
$HCO + HO_2 \to CO_2 + H + OH$	1
$CH_2O + O_2 \to HCO + HO_2$	1
$HCO + HO_2 \to CH_2O + O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$CO_2 + HO_2 \to HOCO + O_2$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$CH_2O + HO_2 \to H_2O_2 + HCO$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$H + HCO \to CO + H_2$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$CO_2 + H \to HOCO$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$H_2 + HCO \to CH_2O + H$	1
$CH_2O + H \to H_2 + HCO$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$2\,HCO \to CH_2O + CO$	1
$CH_2O + CO \to 2\,HCO$	1
$H + HCO \to CH_2O$	1
$CH_2O \to H + HCO$	1
$CH_2O \to CO + H_2$	1
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$CO + OH \to HCO + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$HCO + OH \to CH_2O + O$	2
$CO + OH \to HOCO$	2
$HOCO \to CO + OH$	2
$CO_2 + H + OH \to HCO + HO_2$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2

SanDiego2011

Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
O	1
CO_2	1
HCO	1
H	1
H_2O_2	2
H_2O	2
OH	2
CH_2O	2

Reaction steps	Indices
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$HCO + O \to CO + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$2\,O \to O_2$	1
$HCO + HO_2 \to CH_2O + O_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$HO_2 \to O + OH$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$H + HCO \to CO + H_2$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$H_2 + HCO \to CH_2O + H$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$H + HCO \to CH_2O$	1
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$CO + OH \to HCO + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$HCO + OH \to CH_2O + O$	2
$CH_2O + O \to HCO + OH$	2
$CH_2O + O_2 \to HCO + HO_2$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2
$H_2O + O \to H + HO_2$	2
$CO_2 + OH \to CO + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$O + OH \to HO_2$	2
$CH_2O + HO_2 \to H_2O_2 + HCO$	2
$H_2O_2 + HCO \to CH_2O + HO_2$	2
$CH_2O + OH \to H_2O + HCO$	2
$H_2O + HCO \to CH_2O + OH$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2

SaxenaWilliams2006

Species	Indices
O2	0
CO	0
H2	0
HO2	1
O	1
CO2	1
HCO	1
H	1
H2O2	2
H2O	2
OH	2

Reaction steps	Indices
CO + O2 → CO2 + O	0
O2 → 2 O	0
H2 + O2 → H + HO2	0
CO + H2 → H + HCO	0
H2 → 2 H	0
H + O2 → O + OH	1
HO2 + O → O2 + OH	1
HCO + O → CO + OH	1
H2 + O → H + OH	1
H + O → OH	1
CO2 + O → CO + O2	1
2 O → O2	1
H + HO2 → 2 OH	1
H + HO2 → H2 + O2	1
H + HO2 → H2O + O	1
CO + HO2 → CO2 + OH	1
HCO + O2 → CO + HO2	1
CO + HO2 → HCO + O2	1
2 HO2 → H2O2 + O2	1
HO2 → O + OH	1
H + O2 → HO2	1
HO2 → H + O2	1
H2 + HO2 → H + H2O2	1
H + HCO → CO + H2	1
CO2 + H → CO + OH	1
HCO + O → CO2 + H	1
CO2 + H → HCO + O	1
HCO → CO + H	1
CO + H → HCO	1
2 H → H2	1
HO2 + OH → H2O + O2	2
H2O + O2 → HO2 + OH	2
O + OH → H + O2	2
O2 + OH → HO2 + O	2
CO + OH → HCO + O	2
HO2 + OH → H2O2 + O	2
H2O2 + O → HO2 + OH	2
2 OH → H2O + O	2
H2O + O → 2 OH	2
H + OH → H2 + O	2
OH → H + O	2
H2O2 + OH → H2O + HO2	2
H2O + HO2 → H2O2 + OH	2
2 OH → H + HO2	2
H2O + O → H + HO2	2
CO2 + OH → CO + HO2	2
H2O2 + O2 → 2 HO2	2
O + OH → HO2	2
H2O + OH → H + H2O2	2
H + H2O2 → H2O + OH	2
H + H2O2 → H2 + HO2	2
2 OH → H2O2	2
H2O2 → 2 OH	2
H2 + OH → H + H2O	2
H + H2O → H2 + OH	2
HCO + OH → CO + H2O	2
CO + H2O → HCO + OH	2
H + OH → H2O	2
H2O → H + OH	2
CO + OH → CO2 + H	2

Starik2009

Species	Indices
O2	0
H2	0
CO	0
O3	1
HO2	1
O	1
CO2	1
HCO	1
H	1
H2O2	2
H2O	2
OH	2
CH2O	2

Reaction steps	Indices
$2\,O2 \to O + O3$	0
$CO + O2 \to CO2 + O$	0
$O2 \to 2\,O$	0
$H2 + O2 \to H + HO2$	0
$2\,CO + H2 \to 2\,HCO$	0
$CO + H2 \to H + HCO$	0
$H2 \to 2\,H$	0
$HO2 + O3 \to 2\,O2 + OH$	1
$H2 + O3 \to HO2 + OH$	1
$H + O3 \to O2 + OH$	1
$O3 \to O + O2$	1
$O + O2 \to O3$	1
$HO2 + O2 \to O3 + OH$	1
$H + O2 \to O + OH$	1
$O + O3 \to 2\,O2$	1
$HO2 + O \to O2 + OH$	1
$HCO + O \to CO + OH$	1
$H2 + O \to H + OH$	1
$H + O \to OH$	1
$CO2 + O \to CO + O2$	1
$2\,O \to O2$	1
$HCO + HO2 \to CH2O + O2$	1
$H + HO2 \to 2\,OH$	1
$H + HO2 \to H2 + O2$	1
$H + HO2 \to H2O + O$	1
$CO + HO2 \to CO2 + OH$	1
$HCO + O2 \to CO + HO2$	1
$CO + HO2 \to HCO + O2$	1
$2\,HO2 \to H2O2 + O2$	1
$H + O2 \to HO2$	1
$HO2 \to H + O2$	1
$H2 + HO2 \to H + H2O2$	1
$2\,HCO \to 2\,CO + H2$	1
$H + HCO \to CO + H2$	1
$CO2 + H \to CO + OH$	1
$HCO + O \to CO2 + H$	1
$CO2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$H2 + HCO \to CH2O + H$	1
$2\,H \to H2$	1
$CO + O \to CO2$	1
$CO2 \to CO + O$	1
$2\,HCO \to CH2O + CO$	1
$H + HCO \to CH2O$	1
$2\,O2 + OH \to HO2 + O3$	2
$HO2 + OH \to H2 + O3$	2
$O2 + OH \to H + O3$	2
$O3 + OH \to HO2 + O2$	2
$HO2 + OH \to H2O + O2$	2
$H2O + O2 \to HO2 + OH$	2
$O + OH \to H + O2$	2
$O2 + OH \to HO2 + O$	2
$CO + OH \to HCO + O$	2
$HO2 + OH \to H2O2 + O$	2
$H2O2 + O \to HO2 + OH$	2
$2\,OH \to H2O + O$	2
$H2O + O \to 2\,OH$	2
$H + OH \to H2 + O$	2
$OH \to H + O$	2
$HCO + OH \to CH2O + O$	2
$CH2O + O \to HCO + OH$	2
$CH2O + O2 \to HCO + HO2$	2
$H2O2 + OH \to H2O + HO2$	2

Sun2007

Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
H	1
O	1
CO_2	1
HCO	1
H_2O_2	2
H_2O	2
OH	2
CH_2O	2

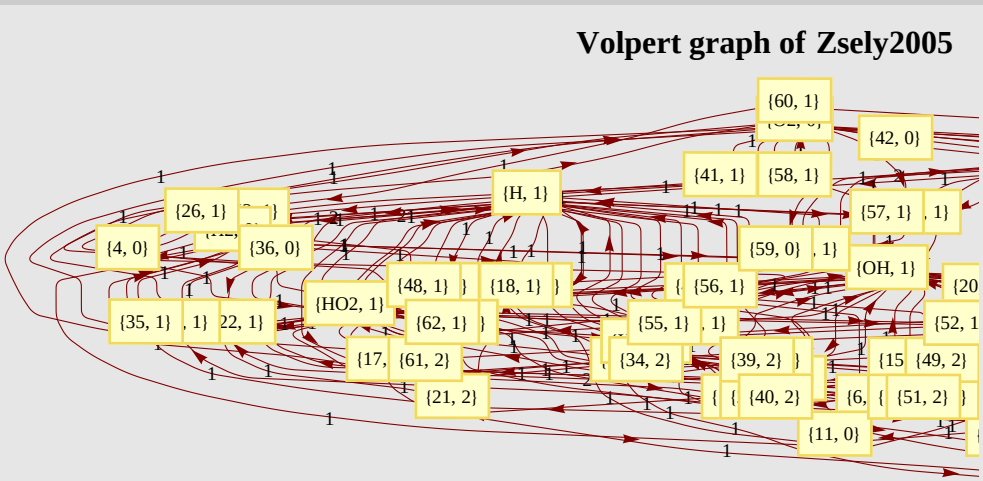
Reaction steps	Indices
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$2\,CO + H_2 \to 2\,HCO$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$H + O_2 \to O + OH$	1
$HO_2 + O \to O_2 + OH$	1
$HCO + O \to CO + OH$	1
$H_2 + O \to H + OH$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$2\,O \to O_2$	1
$HCO + HO_2 \to CO_2 + H + OH$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,HCO \to 2\,CO + H_2$	1
$H + HCO \to CO + H_2$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$2\,HCO \to CH_2O + CO$	1
$HO_2 + OH \to H_2O + O_2$	2
$H_2O + O_2 \to HO_2 + OH$	2
$O + OH \to H + O_2$	2
$O_2 + OH \to HO_2 + O$	2
$CO + OH \to HCO + O$	2
$HO_2 + OH \to H_2O_2 + O$	2
$H_2O_2 + O \to HO_2 + OH$	2
$2\,OH \to H_2O + O$	2
$H_2O + O \to 2\,OH$	2
$H + OH \to H_2 + O$	2
$OH \to H + O$	2
$CO_2 + H + OH \to HCO + HO_2$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$2\,OH \to H + HO_2$	2
$H_2O + O \to H + HO_2$	2
$CO_2 + OH \to CO + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2
$2\,OH \to H_2O_2$	2
$H_2O_2 \to 2\,OH$	2
$H_2 + OH \to H + H_2O$	2
$H + H_2O \to H_2 + OH$	2
$HCO + OH \to CO + H_2O$	2
$CO + H_2O \to HCO + OH$	2
$H + OH \to H_2O$	2
$H_2O \to H + OH$	2

Zsely2005

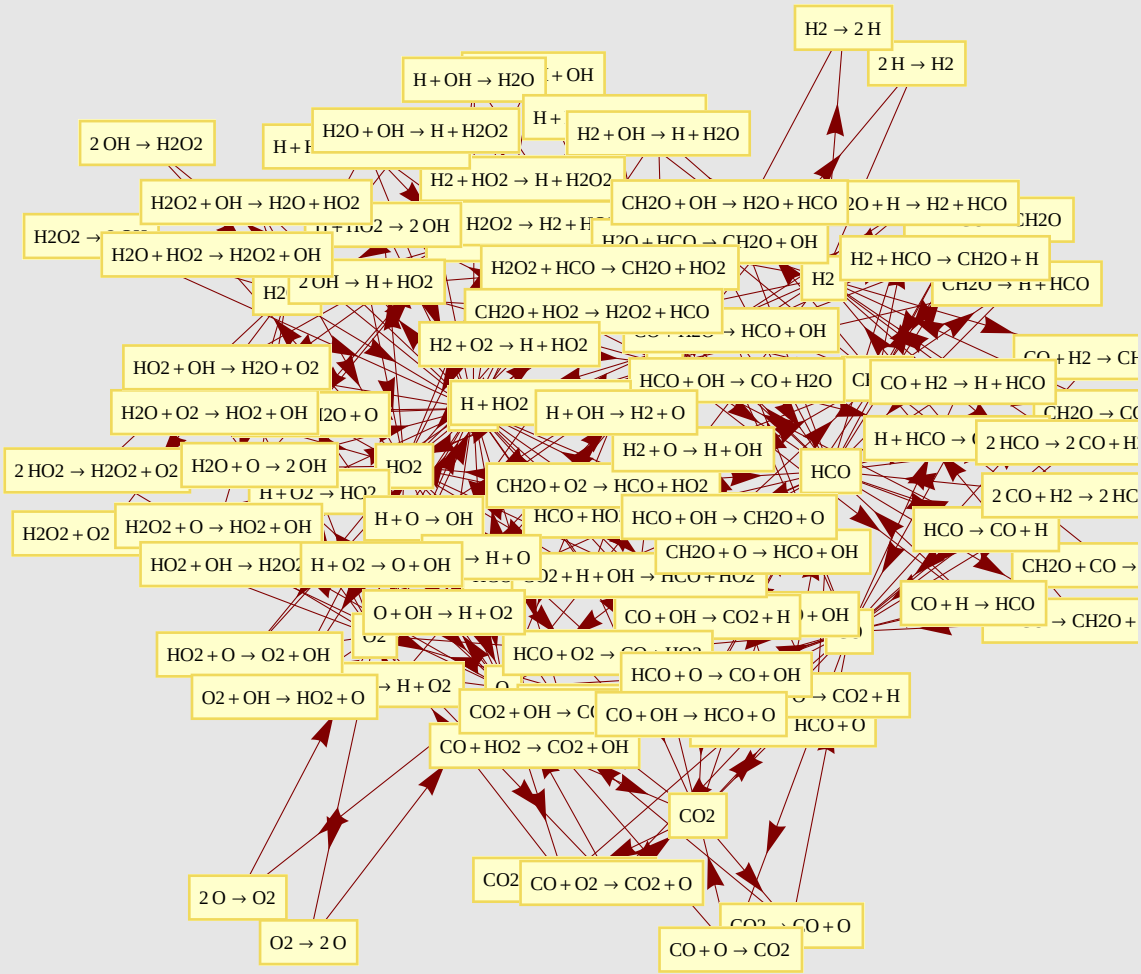
Species	Indices
O_2	0
H_2	0
CO	0
HO_2	1
OH	1
HCO	1
H	1
O	1
CO_2	1
H_2O_2	2
H_2O	2

Reaction steps	Indices
$H_2 + O_2 \to 2\,OH$	0
$CO + O_2 \to CO_2 + O$	0
$O_2 \to 2\,O$	0
$H_2 + O_2 \to H + HO_2$	0
$CO + H_2 \to H + HCO$	0
$H_2 \to 2\,H$	0
$HO_2 + OH \to H_2O + O_2$	1
$2\,OH \to H_2 + O_2$	1
$O + OH \to H + O_2$	1
$H + O_2 \to O + OH$	1
$O_2 + OH \to HO_2 + O$	1
$HO_2 + O \to O_2 + OH$	1
$CO + OH \to HCO + O$	1
$HCO + O \to CO + OH$	1
$HO_2 + OH \to H_2O_2 + O$	1
$2\,OH \to H_2O + O$	1
$H + OH \to H_2 + O$	1
$H_2 + O \to H + OH$	1
$OH \to H + O$	1
$H + O \to OH$	1
$CO_2 + O \to CO + O_2$	1
$2\,O \to O_2$	1
$2\,OH \to H + HO_2$	1
$H + HO_2 \to 2\,OH$	1
$H + HO_2 \to H_2 + O_2$	1
$H + HO_2 \to H_2O + O$	1
$CO_2 + OH \to CO + HO_2$	1
$CO + HO_2 \to CO_2 + OH$	1
$HCO + O_2 \to CO + HO_2$	1
$CO + HO_2 \to HCO + O_2$	1
$2\,HO_2 \to H_2O_2 + O_2$	1
$H + O_2 \to HO_2$	1
$HO_2 \to H + O_2$	1
$H_2 + HO_2 \to H + H_2O_2$	1
$2\,OH \to H_2O_2$	1
$H_2 + OH \to H + H_2O$	1
$HCO + OH \to CO + H_2O$	1
$H + OH \to H_2O$	1
$H + HCO \to CO + H_2$	1
$CO + OH \to CO_2 + H$	1
$CO_2 + H \to CO + OH$	1
$HCO + O \to CO_2 + H$	1
$CO_2 + H \to HCO + O$	1
$HCO \to CO + H$	1
$CO + H \to HCO$	1
$2\,H \to H_2$	1
$CO + O \to CO_2$	1
$CO_2 \to CO + O$	1
$H_2O + O_2 \to HO_2 + OH$	2
$H_2O_2 + O \to HO_2 + OH$	2
$H_2O + O \to 2\,OH$	2
$H_2O_2 + OH \to H_2O + HO_2$	2
$H_2O + HO_2 \to H_2O_2 + OH$	2
$H_2O + O \to H + HO_2$	2
$H_2O_2 + O_2 \to 2\,HO_2$	2
$H_2O + OH \to H + H_2O_2$	2
$H + H_2O_2 \to H_2O + OH$	2
$H + H_2O_2 \to H_2 + HO_2$	2

```
ShowVolpertGraph[coevery[[15, 2]], PlotFunction → "LayeredGraphPlot",
 DirectedEdges → True, VertexLabeling → True, ImageSize → 900,
 PlotLabel → Style["Volpert graph of " <> coevery[[15, 3]], 15, Bold, Black],
 EdgeLabeling → True, Numbered → True, Indexed → {"H2", "O2", "CO"},
 MultiedgeStyle → True, PlotRangeClipping → True]
```



```
ShowVolpertGraph[coevery[[8, 2]], MultiedgeStyle → True,
 DirectedEdges → True, VertexLabeling → True,
 PlotLabel → Style["Volpert graph of " <> coevery[[2, 3]], 15, Bold, Black],
 ImageSize → 600]
```




```
ReversibleQ /@ coevery[[reducedindices, 2]]
```

```
{True, False, True, True, True, False, True, True, True, True, True, True, True}
```

```
db = Sort[DetailedBalanced[#], Total[Length /@ (#1 /. Equal → List)] <
       Total[Length /@ (#2 /. Equal → List)] &] & /@
  coevery[[Delete[reducedindices, {{2}, {6}}], 2]]
```

$$\{\{k_2\, k_8\, k_9 == k_1\, k_7\, k_{10},\ k_1\, k_4\, k_{11} == k_2\, k_3\, k_{12},\ k_8\, k_{20}\, k_{23} == k_7\, k_{19}\, k_{24},$$
$$k_{19}\, k_{26}\, k_{29} == k_{20}\, k_{25}\, k_{30},\ k_1\, k_{20}\, k_{31} == k_2\, k_{19}\, k_{32},\ k_8\, k_{36}\, k_{45} == k_7\, k_{35}\, k_{46},$$
$$k_1\, k_{36}\, k_{51} == k_2\, k_{35}\, k_{52},\ k_{20}\, k_{35}\, k_{71} == k_{19}\, k_{36}\, k_{72},\ k_{44}\, k_{47}\, k_{62} == k_{43}\, k_{48}\, k_{61},$$

$$k_{14}\,k_{15}\,k_{66} == k_{13}\,k_{16}\,k_{65},\ k_1\,k_4\,k_6\,k_{13} == k_2\,k_3\,k_5\,k_{14},\ k_1\,k_4\,k_7\,k_{17} == k_2\,k_3\,k_8\,k_{18},$$
$$k_1\,k_4\,k_{20}\,k_{21} == k_2\,k_3\,k_{19}\,k_{22},\ k_1\,k_7\,k_{28}\,k_{33} == k_2\,k_8\,k_{27}\,k_{34},\ k_8\,k_{27}\,k_{36}\,k_{37} == k_7\,k_{28}\,k_{35}\,k_{38},$$
$$k_1\,k_4\,k_{36}\,k_{39} == k_2\,k_3\,k_{35}\,k_{40},\ k_8\,k_{26}\,k_{27}\,k_{47} == k_7\,k_{25}\,k_{28}\,k_{48},\ k_5\,k_{16}\,k_{20}\,k_{61} == k_6\,k_{15}\,k_{19}\,k_{62},$$
$$k_8\,k_{20}\,k_{27}\,k_{49} == k_7\,k_{19}\,k_{28}\,k_{50},\ k_2\,k_5\,k_{16}\,k_{55} == k_1\,k_6\,k_{15}\,k_{56},\ k_5\,k_7\,k_{16}\,k_{59} == k_6\,k_8\,k_{15}\,k_{60},$$
$$k_5\,k_{16}\,k_{36}\,k_{67} == k_6\,k_{15}\,k_{35}\,k_{68},\ k_8\,k_{15}\,k_{26}\,k_{27}\,k_{41} == k_7\,k_{16}\,k_{25}\,k_{28}\,k_{42},$$
$$k_5\,k_7\,k_{16}\,k_{28}\,k_{63} == k_6\,k_8\,k_{15}\,k_{27}\,k_{64},\ k_5^2\,k_7\,k_{16}^2\,k_{25}\,k_{28}\,k_{36}\,k_{53} == k_6^2\,k_8\,k_{15}^2\,k_{26}\,k_{27}\,k_{35}\,k_{54},$$
$$k_5\,k_7\,k_{16}^2\,k_{25}\,k_{28}\,k_{36}\,k_{57} == k_6\,k_8\,k_{15}^2\,k_{26}\,k_{27}\,k_{35}\,k_{58},$$
$$k_6\,k_8\,k_{15}\,k_{26}\,k_{27}\,k_{35}\,k_{69} == k_5\,k_7\,k_{16}\,k_{25}\,k_{28}\,k_{36}\,k_{70}\Big\},$$

$$\Big\{k_4\,k_8\,k_9 == k_3\,k_7\,k_{10},\ k_5\,k_8\,k_{13} == k_6\,k_7\,k_{14},\ k_5\,k_8^2\,k_{15} == k_6\,k_7^2\,k_{16},$$
$$k_8\,k_{18}\,k_{19} == k_7\,k_{17}\,k_{20},\ k_6\,k_{18}\,k_{21} == k_5\,k_{17}\,k_{22},\ k_{17}\,k_{24}\,k_{27} == k_{18}\,k_{23}\,k_{28},$$
$$k_8\,k_{30}\,k_{33} == k_7\,k_{29}\,k_{34},\ k_3\,k_{12}\,k_{51} == k_4\,k_{11}\,k_{52},\ k_{18}\,k_{29}\,k_{67} == k_{17}\,k_{30}\,k_{68},$$
$$k_{40}\,k_{41}\,k_{66} == k_{39}\,k_{42}\,k_{65},\ k_{38}\,k_{41}\,k_{56} == k_{37}\,k_{42}\,k_{55},\ k_{10}\,k_{11}\,k_{60} == k_9\,k_{12}\,k_{59},$$
$$k_6\,k_{25}\,k_{30}\,k_{31} == k_5\,k_{26}\,k_{29}\,k_{32},\ k_6\,k_{24}\,k_{25}\,k_{41} == k_5\,k_{23}\,k_{26}\,k_{42},$$
$$k_3\,k_{12}\,k_{18}\,k_{55} == k_4\,k_{11}\,k_{17}\,k_{56},\ k_{24}\,k_{25}\,k_{29}\,k_{65} == k_{23}\,k_{26}\,k_{30}\,k_{66},$$
$$k_6\,k_{18}\,k_{25}\,k_{43} == k_5\,k_{17}\,k_{26}\,k_{44},\ k_3\,k_5\,k_{12}\,k_{53} == k_4\,k_6\,k_{11}\,k_{54},$$
$$k_3\,k_{12}\,k_{30}\,k_{61} == k_4\,k_{11}\,k_{29}\,k_{62},\ k_6\,k_{11}\,k_{24}\,k_{25}\,k_{35} == k_5\,k_{12}\,k_{23}\,k_{26}\,k_{36},$$
$$k_3\,k_5\,k_{12}\,k_{26}\,k_{57} == k_4\,k_6\,k_{11}\,k_{25}\,k_{58},\ k_6\,k_7\,k_{11}\,k_{24}\,k_{25}\,k_{45} == k_5\,k_8\,k_{12}\,k_{23}\,k_{26}\,k_{46},$$
$$k_3^2\,k_5\,k_{12}^2\,k_{23}\,k_{26}\,k_{30}\,k_{47} == k_4^2\,k_6\,k_{11}^2\,k_{24}\,k_{25}\,k_{29}\,k_{48},$$
$$k_3\,k_5\,k_{12}^2\,k_{23}\,k_{26}\,k_{30}\,k_{49} == k_4\,k_6\,k_{11}^2\,k_{24}\,k_{25}\,k_{29}\,k_{50},$$
$$k_4\,k_6\,k_{11}\,k_{24}\,k_{25}\,k_{29}\,k_{63} == k_3\,k_5\,k_{12}\,k_{23}\,k_{26}\,k_{30}\,k_{64}\Big\},$$

$$\Big\{k_2\,k_6\,k_7 == k_1\,k_5\,k_8,\ k_3\,k_6\,k_{11} == k_4\,k_5\,k_{12},\ k_6\,k_{14}\,k_{15} == k_5\,k_{13}\,k_{16},\ k_4\,k_{14}\,k_{17} == k_3\,k_{13}\,k_{18},$$
$$k_{13}\,k_{20}\,k_{23} == k_{14}\,k_{19}\,k_{24},\ k_6\,k_{26}\,k_{29} == k_5\,k_{25}\,k_{30},\ k_4\,k_{26}\,k_{35} == k_3\,k_{25}\,k_{36},$$
$$k_1\,k_{10}\,k_{45} == k_2\,k_9\,k_{46},\ k_{14}\,k_{25}\,k_{59} == k_{13}\,k_{26}\,k_{60},\ k_{34}\,k_{37}\,k_{50} == k_{33}\,k_{38}\,k_{49},$$
$$k_8\,k_9\,k_{54} == k_7\,k_{10}\,k_{53},\ k_4\,k_{21}\,k_{26}\,k_{27} == k_3\,k_{22}\,k_{25}\,k_{28},\ k_4\,k_{20}\,k_{21}\,k_{37} == k_3\,k_{19}\,k_{22}\,k_{38},$$
$$k_1\,k_{10}\,k_{14}\,k_{49} == k_2\,k_9\,k_{13}\,k_{50},\ k_4\,k_{14}\,k_{21}\,k_{39} == k_3\,k_{13}\,k_{22}\,k_{40},\ k_1\,k_3\,k_{10}\,k_{47} == k_2\,k_4\,k_9\,k_{48},$$
$$k_1\,k_{10}\,k_{26}\,k_{55} == k_2\,k_9\,k_{25}\,k_{56},\ k_4\,k_9\,k_{20}\,k_{21}\,k_{31} == k_3\,k_{10}\,k_{19}\,k_{22}\,k_{32},$$
$$k_1\,k_3\,k_{10}\,k_{22}\,k_{51} == k_2\,k_4\,k_9\,k_{21}\,k_{52},\ k_1^2\,k_3\,k_{10}^2\,k_{19}\,k_{22}\,k_{26}\,k_{41} == k_2^2\,k_4\,k_9^2\,k_{20}\,k_{21}\,k_{25}\,k_{42},$$
$$k_1\,k_3\,k_{10}^2\,k_{19}\,k_{22}\,k_{26}\,k_{43} == k_2\,k_4\,k_9^2\,k_{20}\,k_{21}\,k_{25}\,k_{44},$$
$$k_2\,k_4\,k_9\,k_{20}\,k_{21}\,k_{25}\,k_{57} == k_1\,k_3\,k_{10}\,k_{19}\,k_{22}\,k_{26}\,k_{58}\Big\},$$

$$\Big\{k_4\,k_8\,k_9 == k_3\,k_7\,k_{10},\ k_8\,k_{20}\,k_{23} == k_7\,k_{19}\,k_{24},\ k_{19}\,k_{26}\,k_{29} == k_{20}\,k_{25}\,k_{30},$$
$$k_3\,k_{20}\,k_{31} == k_4\,k_{19}\,k_{32},\ k_8\,k_{36}\,k_{45} == k_7\,k_{35}\,k_{46},\ k_3\,k_{36}\,k_{51} == k_4\,k_{35}\,k_{52},$$
$$k_5\,k_{16}\,k_{59} == k_6\,k_{15}\,k_{60},\ k_{20}\,k_{35}\,k_{73} == k_{19}\,k_{36}\,k_{74},\ k_{44}\,k_{47}\,k_{64} == k_{43}\,k_{48}\,k_{63},$$
$$k_{14}\,k_{15}\,k_{68} == k_{13}\,k_{16}\,k_{67},\ k_2\,k_3\,k_{18} == k_1\,k_4\,k_{17},\ k_1\,k_4\,k_8\,k_{11} == k_2\,k_3\,k_7\,k_{12},$$
$$k_3\,k_7\,k_{28}\,k_{33} == k_4\,k_8\,k_{27}\,k_{34},\ k_8\,k_{27}\,k_{36}\,k_{37} == k_7\,k_{28}\,k_{35}\,k_{38},\ k_8\,k_{26}\,k_{27}\,k_{47} == k_7\,k_{25}\,k_{28}\,k_{48},$$
$$k_5\,k_{16}\,k_{20}\,k_{63} == k_6\,k_{15}\,k_{19}\,k_{64},\ k_8\,k_{20}\,k_{27}\,k_{49} == k_7\,k_{19}\,k_{28}\,k_{50},$$
$$k_4\,k_5\,k_{16}\,k_{55} == k_3\,k_6\,k_{15}\,k_{56},\ k_5\,k_7\,k_{16}\,k_{61} == k_6\,k_8\,k_{15}\,k_{62},\ k_5\,k_{16}\,k_{36}\,k_{69} == k_6\,k_{15}\,k_{35}\,k_{70},$$
$$k_1\,k_4\,k_6\,k_8\,k_{13} == k_2\,k_3\,k_5\,k_7\,k_{14},\ k_1\,k_4\,k_8\,k_{20}\,k_{21} == k_2\,k_3\,k_7\,k_{19}\,k_{22},$$
$$k_1\,k_4\,k_8\,k_{36}\,k_{39} == k_2\,k_3\,k_7\,k_{35}\,k_{40},\ k_8\,k_{15}\,k_{26}\,k_{27}\,k_{41} == k_7\,k_{16}\,k_{25}\,k_{28}\,k_{42},$$
$$k_5\,k_7\,k_{16}\,k_{28}\,k_{65} == k_6\,k_8\,k_{15}\,k_{27}\,k_{66},\ k_5^2\,k_7\,k_{16}^2\,k_{25}\,k_{28}\,k_{36}\,k_{53} == k_6^2\,k_8\,k_{15}^2\,k_{26}\,k_{27}\,k_{35}\,k_{54},$$
$$k_5\,k_7\,k_{16}^2\,k_{25}\,k_{28}\,k_{36}\,k_{57} == k_6\,k_8\,k_{15}^2\,k_{26}\,k_{27}\,k_{35}\,k_{58},$$
$$k_6\,k_8\,k_{15}\,k_{26}\,k_{27}\,k_{35}\,k_{71} == k_5\,k_7\,k_{16}\,k_{25}\,k_{28}\,k_{36}\,k_{72}\Big\},$$

$$\Big\{k_3\,k_6\,k_{13} == k_4\,k_5\,k_{14},\ k_1\,k_6\,k_{21} == k_2\,k_5\,k_{22},\ k_{23}\,k_{30}\,k_{33} == k_{24}\,k_{29}\,k_{34},$$
$$k_3\,k_{24}\,k_{35} == k_4\,k_{23}\,k_{36},\ k_3\,k_{40}\,k_{53} == k_4\,k_{39}\,k_{54},\ k_7\,k_{18}\,k_{63} == k_8\,k_{17}\,k_{64},$$
$$k_{24}\,k_{39}\,k_{77} == k_{23}\,k_{40}\,k_{78},\ k_{16}\,k_{17}\,k_{72} == k_{15}\,k_{18}\,k_{71},\ k_2\,k_3\,k_{20} == k_1\,k_4\,k_{19},$$
$$k_2\,k_3^2\,k_6\,k_9 == k_1\,k_4^2\,k_5\,k_{10},\ k_2\,k_3\,k_6\,k_{11} == k_1\,k_4\,k_5\,k_{12},\ k_3\,k_6\,k_8\,k_{15} == k_4\,k_5\,k_7\,k_{16},$$
$$k_3\,k_6\,k_{24}\,k_{25} == k_4\,k_5\,k_{23}\,k_{26},\ k_3\,k_6\,k_{40}\,k_{43} == k_4\,k_5\,k_{39}\,k_{44},$$
$$k_4\,k_7\,k_{18}\,k_{59} == k_3\,k_8\,k_{17}\,k_{60},\ k_7\,k_{18}\,k_{24}\,k_{67} == k_8\,k_{17}\,k_{23}\,k_{68},$$
$$k_7\,k_{18}\,k_{40}\,k_{73} == k_8\,k_{17}\,k_{39}\,k_{74},\ k_2\,k_3^2\,k_6\,k_{24}\,k_{27} == k_1\,k_4^2\,k_5\,k_{23}\,k_{28},$$
$$k_1\,k_4\,k_5\,k_{32}\,k_{37} == k_2\,k_3\,k_6\,k_{31}\,k_{38},\ k_2\,k_3^2\,k_6\,k_{40}\,k_{47} == k_1\,k_4^2\,k_5\,k_{39}\,k_{48},$$
$$k_2\,k_3^2\,k_6\,k_{31}\,k_{40}\,k_{41} == k_1\,k_4^2\,k_5\,k_{32}\,k_{39}\,k_{42},\ k_2\,k_3^2\,k_6\,k_{30}\,k_{31}\,k_{49} == k_1\,k_4^2\,k_5\,k_{29}\,k_{32}\,k_{50},$$
$$k_2\,k_3^2\,k_6\,k_{24}\,k_{31}\,k_{51} == k_1\,k_4^2\,k_5\,k_{23}\,k_{32}\,k_{52},\ k_2\,k_3\,k_{17}\,k_{30}\,k_{31}\,k_{55} == k_1\,k_4\,k_{18}\,k_{29}\,k_{32}\,k_{56},$$

$$k_1 k_4^2 k_5 k_7 k_{18} k_{65} == k_2 k_3^2 k_6 k_8 k_{17} k_{66},\ k_2 k_3^2 k_6 k_{17} k_{30} k_{31} k_{45} == k_1 k_4^2 k_5 k_{18} k_{29} k_{32} k_{46},$$
$$k_1 k_4^2 k_5 k_7 k_{18} k_{32} k_{69} == k_2 k_3^2 k_6 k_8 k_{17} k_{31} k_{70},$$
$$k_1 k_4^2 k_5 k_7^2 k_{18}^2 k_{29} k_{32} k_{40} k_{57} == k_2 k_3^2 k_6 k_8^2 k_{17}^2 k_{30} k_{31} k_{39} k_{58},$$
$$k_1 k_4^2 k_5 k_7 k_{18}^2 k_{29} k_{32} k_{40} k_{61} == k_2 k_3^2 k_6 k_8 k_{17}^2 k_{30} k_{31} k_{39} k_{62},$$
$$k_2 k_3^2 k_6 k_8 k_{17} k_{30} k_{31} k_{39} k_{75} == k_1 k_4^2 k_5 k_7 k_{18} k_{29} k_{32} k_{40} k_{76}\},$$

$$\{k_3 k_6 k_{13} == k_4 k_5 k_{14},\ k_{16} k_{24} k_{27} == k_{15} k_{23} k_{28},\ k_{23} k_{32} k_{37} == k_{24} k_{31} k_{38},$$
$$k_3 k_{24} k_{39} == k_4 k_{23} k_{40},\ k_{16} k_{44} k_{51} == k_{15} k_{43} k_{52},\ k_3 k_{44} k_{61} == k_4 k_{43} k_{62},$$
$$k_7 k_{20} k_{73} == k_8 k_{19} k_{74},\ k_{24} k_{43} k_{87} == k_{23} k_{44} k_{88},\ k_{54} k_{57} k_{78} == k_{53} k_{58} k_{77},$$
$$k_{18} k_{19} k_{82} == k_{17} k_{20} k_{81},\ k_{16} k_{19} k_{66} == k_{15} k_{20} k_{65},\ k_2 k_3 k_{22} == k_1 k_4 k_{21},$$
$$k_2 k_3^2 k_6 k_9 == k_1 k_4^2 k_5 k_{10},\ k_2 k_3 k_6 k_{11} == k_1 k_4 k_5 k_{12},\ k_3 k_6 k_8 k_{17} == k_4 k_5 k_7 k_{18},$$
$$k_3 k_6 k_{24} k_{25} == k_4 k_5 k_{23} k_{26},\ k_{16} k_{19} k_{32} k_{33} == k_{15} k_{20} k_{31} k_{34},$$
$$k_3 k_6 k_{44} k_{47} == k_4 k_5 k_{43} k_{48},\ k_7 k_{20} k_{24} k_{77} == k_8 k_{19} k_{23} k_{78},\ k_4 k_7 k_{20} k_{69} == k_3 k_8 k_{19} k_{70},$$
$$k_7 k_{20} k_{44} k_{83} == k_8 k_{19} k_{43} k_{84},\ k_2 k_3^2 k_6 k_{24} k_{29} == k_1 k_4^2 k_5 k_{23} k_{30},$$
$$k_1 k_4 k_5 k_{36} k_{41} == k_2 k_3 k_6 k_{35} k_{42},\ k_2 k_3^2 k_6 k_{44} k_{55} == k_1 k_4^2 k_5 k_{43} k_{56},$$
$$k_2 k_3^2 k_6 k_{35} k_{44} k_{45} == k_1 k_4^2 k_5 k_{36} k_{43} k_{46},\ k_2 k_3^2 k_6 k_{32} k_{35} k_{57} == k_1 k_4^2 k_5 k_{31} k_{36} k_{58},$$
$$k_2 k_3^2 k_6 k_{24} k_{35} k_{59} == k_1 k_4^2 k_5 k_{23} k_{36} k_{60},\ k_2 k_3 k_{19} k_{32} k_{35} k_{63} == k_1 k_4 k_{20} k_{31} k_{36} k_{64},$$
$$k_1 k_4^2 k_5 k_7 k_{20} k_{75} == k_2 k_3^2 k_6 k_8 k_{19} k_{76},\ k_2 k_3^2 k_6 k_{19} k_{32} k_{35} k_{49} == k_1 k_4^2 k_5 k_{20} k_{31} k_{36} k_{50},$$
$$k_1 k_4^2 k_5 k_7 k_{20} k_{36} k_{79} == k_2 k_3^2 k_6 k_8 k_{19} k_{35} k_{80},$$
$$k_1 k_4^2 k_5 k_7^2 k_{20}^2 k_{31} k_{36} k_{44} k_{67} == k_2 k_3^2 k_6 k_8^2 k_{19}^2 k_{32} k_{35} k_{43} k_{68},$$
$$k_1 k_4^2 k_5 k_7 k_{20}^2 k_{31} k_{36} k_{44} k_{71} == k_2 k_3^2 k_6 k_8 k_{19}^2 k_{32} k_{35} k_{43} k_{72},$$
$$k_2 k_3^2 k_6 k_8 k_{19} k_{32} k_{35} k_{43} k_{85} == k_1 k_4^2 k_5 k_7 k_{20} k_{31} k_{36} k_{44} k_{86}\},$$

$$\{k_2 k_6 k_7 == k_1 k_5 k_8,\ k_4 k_{10} k_{11} == k_3 k_9 k_{12},\ k_5 k_{10} k_{15} == k_6 k_9 k_{16},$$
$$k_{10} k_{18} k_{19} == k_9 k_{17} k_{20},\ k_6 k_{18} k_{21} == k_5 k_{17} k_{22},\ k_{17} k_{24} k_{27} == k_{18} k_{23} k_{28},$$
$$k_1 k_{18} k_{29} == k_2 k_{17} k_{30},\ k_{10} k_{34} k_{39} == k_9 k_{33} k_{40},\ k_6 k_{34} k_{45} == k_5 k_{33} k_{46},$$
$$k_1 k_{34} k_{51} == k_2 k_{33} k_{52},\ k_3 k_{14} k_{59} == k_4 k_{13} k_{60},\ k_{18} k_{33} k_{73} == k_{17} k_{34} k_{74},$$
$$k_{44} k_{47} k_{64} == k_{43} k_{48} k_{63},\ k_{34} k_{35} k_{72} == k_{33} k_{36} k_{71},\ k_{12} k_{13} k_{68} == k_{11} k_{14} k_{67},$$
$$k_1 k_5 k_{26} k_{31} == k_2 k_6 k_{25} k_{32},\ k_6 k_{25} k_{34} k_{37} == k_5 k_{26} k_{33} k_{38},$$
$$k_6 k_{24} k_{25} k_{47} == k_5 k_{23} k_{26} k_{48},\ k_3 k_{14} k_{18} k_{63} == k_4 k_{13} k_{17} k_{64},$$
$$k_6 k_{18} k_{25} k_{49} == k_5 k_{17} k_{26} k_{50},\ k_2 k_3 k_{14} k_{55} == k_1 k_4 k_{13} k_{56},\ k_3 k_5 k_{14} k_{61} == k_4 k_6 k_{13} k_{62},$$
$$k_3 k_{14} k_{34} k_{69} == k_4 k_{13} k_{33} k_{70},\ k_6 k_{13} k_{24} k_{25} k_{41} == k_5 k_{14} k_{23} k_{26} k_{42},$$
$$k_3 k_5 k_{14} k_{26} k_{65} == k_4 k_6 k_{13} k_{25} k_{66},\ k_4 k_6 k_{13} k_{24} k_{25} k_{35} == k_3 k_5 k_{14} k_{23} k_{26} k_{36},$$
$$k_3^2 k_5 k_{14}^2 k_{23} k_{26} k_{34} k_{53} == k_4^2 k_6 k_{13}^2 k_{24} k_{25} k_{33} k_{54},$$
$$k_3 k_5 k_{14}^2 k_{23} k_{26} k_{34} k_{57} == k_4 k_6 k_{13}^2 k_{24} k_{25} k_{33} k_{58}\},$$

$$\{k_1 k_4 k_9 == k_2 k_3 k_{10},\ k_4 k_{12} k_{13} == k_3 k_{11} k_{14},\ k_2 k_{12} k_{15} == k_1 k_{11} k_{16},$$
$$k_{11} k_{18} k_{21} == k_{12} k_{17} k_{22},\ k_4 k_{24} k_{29} == k_3 k_{23} k_{30},\ k_2 k_{24} k_{35} == k_1 k_{23} k_{36},$$
$$k_{12} k_{23} k_{59} == k_{11} k_{24} k_{60},\ k_{34} k_{37} k_{50} == k_{33} k_{38} k_{49},\ k_{24} k_{25} k_{58} == k_{23} k_{26} k_{57},$$
$$k_6 k_7 k_{54} == k_5 k_8 k_{53},\ k_2 k_{19} k_{24} k_{27} == k_1 k_{20} k_{23} k_{28},\ k_2 k_{18} k_{19} k_{37} == k_1 k_{17} k_{20} k_{38},$$
$$k_2 k_{12} k_{19} k_{39} == k_1 k_{11} k_{20} k_{40},\ k_4 k_5 k_8 k_{45} == k_3 k_6 k_7 k_{46},$$
$$k_2 k_7 k_{18} k_{19} k_{31} == k_1 k_8 k_{17} k_{20} k_{32},\ k_4 k_5 k_8 k_{12} k_{49} == k_3 k_6 k_7 k_{11} k_{50},$$
$$k_1 k_4 k_5 k_8 k_{47} == k_2 k_3 k_6 k_7 k_{48},\ k_4 k_5 k_8 k_{24} k_{55} == k_3 k_6 k_7 k_{23} k_{56},$$
$$k_1 k_4 k_5 k_8 k_{20} k_{51} == k_2 k_3 k_6 k_7 k_{19} k_{52},\ k_2 k_3 k_6 k_7 k_{18} k_{19} k_{25} == k_1 k_4 k_5 k_8 k_{17} k_{20} k_{26},$$
$$k_1 k_4^2 k_5^2 k_8^2 k_{17} k_{20} k_{24} k_{41} == k_2 k_3^2 k_6^2 k_7^2 k_{18} k_{19} k_{23} k_{42},$$
$$k_1 k_4 k_5 k_8^2 k_{17} k_{20} k_{24} k_{43} == k_2 k_3 k_6 k_7^2 k_{18} k_{19} k_{23} k_{44}\},$$

$$\{k_2 k_8 k_9 == k_1 k_7 k_{10},\ k_1 k_4 k_{11} == k_2 k_3 k_{12},\ k_8 k_{22} k_{25} == k_7 k_{21} k_{26},$$
$$k_{21} k_{28} k_{31} == k_{22} k_{27} k_{32},\ k_1 k_{22} k_{33} == k_2 k_{21} k_{34},\ k_8 k_{38} k_{47} == k_7 k_{37} k_{48},$$
$$k_1 k_{38} k_{53} == k_2 k_{37} k_{54},\ k_5 k_{16} k_{61} == k_6 k_{15} k_{62},\ k_{22} k_{37} k_{77} == k_{21} k_{38} k_{78},$$
$$k_{46} k_{49} k_{66} == k_{45} k_{50} k_{65},\ k_{14} k_{15} k_{70} == k_{13} k_{16} k_{69},\ k_1 k_4 k_6 k_{13} == k_2 k_3 k_5 k_{14},$$
$$k_1 k_4 k_7 k_{17} == k_2 k_3 k_8 k_{18},\ k_1^2 k_4^2 k_7 k_{19} == k_2^2 k_3^2 k_8 k_{20},\ k_1 k_4 k_{22} k_{23} == k_2 k_3 k_{21} k_{24},$$
$$k_1 k_7 k_{30} k_{35} == k_2 k_8 k_{29} k_{36},\ k_8 k_{29} k_{38} k_{39} == k_7 k_{30} k_{37} k_{40},$$
$$k_1 k_4 k_{38} k_{41} == k_2 k_3 k_{37} k_{42},\ k_8 k_{28} k_{29} k_{49} == k_7 k_{27} k_{30} k_{50},$$
$$k_5 k_{16} k_{22} k_{65} == k_6 k_{15} k_{21} k_{66},\ k_8 k_{22} k_{29} k_{51} == k_7 k_{21} k_{30} k_{52},$$

$$k_2\,k_5\,k_{16}\,k_{57} == k_1\,k_6\,k_{15}\,k_{58},\ k_5\,k_7\,k_{16}\,k_{63} == k_6\,k_8\,k_{15}\,k_{64},\ k_5\,k_{16}\,k_{38}\,k_{71} == k_6\,k_{15}\,k_{37}\,k_{72},$$
$$k_8\,k_{15}\,k_{28}\,k_{29}\,k_{43} == k_7\,k_{16}\,k_{27}\,k_{30}\,k_{44},\ k_5\,k_7\,k_{16}\,k_{30}\,k_{67} == k_6\,k_8\,k_{15}\,k_{29}\,k_{68},$$
$$k_5\,k_{16}\,k_{38}\,k_{74}\,k_{79} == k_6\,k_{15}\,k_{37}\,k_{73}\,k_{80},\ k_5^2\,k_7\,k_{16}^2\,k_{27}\,k_{30}\,k_{38}\,k_{55} == k_6^2\,k_8\,k_{15}^2\,k_{28}\,k_{29}\,k_{37}\,k_{56},$$
$$k_5\,k_7\,k_{16}^2\,k_{27}\,k_{30}\,k_{38}\,k_{59} == k_6\,k_8\,k_{15}^2\,k_{28}\,k_{29}\,k_{37}\,k_{60},$$
$$k_6\,k_8\,k_{15}\,k_{28}\,k_{29}\,k_{37}\,k_{75} == k_5\,k_7\,k_{16}\,k_{27}\,k_{30}\,k_{38}\,k_{76},$$
$$k_6\,k_{15}\,k_{28}\,k_{29}\,k_{37}^2\,k_{73}\,k_{85} == k_5\,k_{16}\,k_{27}\,k_{30}\,k_{38}^2\,k_{74}\,k_{86},$$
$$k_6\,k_8\,k_{15}\,k_{28}\,k_{29}\,k_{73}\,k_{87} == k_5\,k_7\,k_{16}\,k_{27}\,k_{30}\,k_{74}\,k_{88},$$
$$k_5^2\,k_7\,k_{16}^2\,k_{27}\,k_{30}\,k_{38}\,k_{74}\,k_{81} == k_6^2\,k_8\,k_{15}^2\,k_{28}\,k_{29}\,k_{37}\,k_{73}\,k_{82},$$
$$k_6\,k_8\,k_{15}\,k_{28}\,k_{29}\,k_{37}\,k_{73}\,k_{83} == k_5\,k_7\,k_{16}\,k_{27}\,k_{30}\,k_{38}\,k_{74}\,k_{84}\},$$

$$\{k_4\,k_8\,k_9 == k_3\,k_7\,k_{10},\ k_5\,k_8\,k_{13} == k_6\,k_7\,k_{14},\ k_5\,k_8^2\,k_{15} == k_6\,k_7^2\,k_{16},$$
$$k_8\,k_{18}\,k_{19} == k_7\,k_{17}\,k_{20},\ k_6\,k_{18}\,k_{21} == k_5\,k_{17}\,k_{22},\ k_{17}\,k_{24}\,k_{27} == k_{18}\,k_{23}\,k_{28},$$
$$k_8\,k_{30}\,k_{33} == k_7\,k_{29}\,k_{34},\ k_6\,k_{30}\,k_{39} == k_5\,k_{29}\,k_{40},\ k_3\,k_{12}\,k_{51} == k_4\,k_{11}\,k_{52},$$
$$k_{18}\,k_{29}\,k_{65} == k_{17}\,k_{30}\,k_{66},\ k_{38}\,k_{41}\,k_{56} == k_{37}\,k_{42}\,k_{55},\ k_{10}\,k_{11}\,k_{60} == k_9\,k_{12}\,k_{59},$$
$$k_6\,k_{25}\,k_{30}\,k_{31} == k_5\,k_{26}\,k_{29}\,k_{32},\ k_6\,k_{24}\,k_{25}\,k_{41} == k_5\,k_{23}\,k_{26}\,k_{42},$$
$$k_3\,k_{12}\,k_{18}\,k_{55} == k_4\,k_{11}\,k_{17}\,k_{56},\ k_6\,k_{18}\,k_{25}\,k_{43} == k_5\,k_{17}\,k_{26}\,k_{44},\ k_3\,k_5\,k_{12}\,k_{53} == k_4\,k_6\,k_{11}\,k_{54},$$
$$k_3\,k_{12}\,k_{30}\,k_{61} == k_4\,k_{11}\,k_{29}\,k_{62},\ k_6\,k_{11}\,k_{24}\,k_{25}\,k_{35} == k_5\,k_{12}\,k_{23}\,k_{26}\,k_{36},$$
$$k_3\,k_5\,k_{12}\,k_{26}\,k_{57} == k_4\,k_6\,k_{11}\,k_{25}\,k_{58},\ k_6\,k_7\,k_{11}\,k_{24}\,k_{25}\,k_{45} == k_5\,k_8\,k_{12}\,k_{23}\,k_{26}\,k_{46},$$
$$k_3^2\,k_5\,k_{12}^2\,k_{23}\,k_{26}\,k_{30}\,k_{47} == k_4^2\,k_6\,k_{11}^2\,k_{24}\,k_{25}\,k_{29}\,k_{48},$$
$$k_3\,k_5\,k_{12}^2\,k_{23}\,k_{26}\,k_{30}\,k_{49} == k_4\,k_6\,k_{11}^2\,k_{24}\,k_{25}\,k_{29}\,k_{50},$$
$$k_4\,k_6\,k_{11}\,k_{24}\,k_{25}\,k_{29}\,k_{63} == k_3\,k_5\,k_{12}\,k_{23}\,k_{26}\,k_{30}\,k_{64}\},$$

$$\{k_2\,k_6\,k_7 == k_1\,k_5\,k_8,\ k_3\,k_6\,k_{11} == k_4\,k_5\,k_{12},\ k_6\,k_{14}\,k_{15} == k_5\,k_{13}\,k_{16},\ k_4\,k_{14}\,k_{17} == k_3\,k_{13}\,k_{18},$$
$$k_{13}\,k_{20}\,k_{23} == k_{14}\,k_{19}\,k_{24},\ k_6\,k_{26}\,k_{29} == k_5\,k_{25}\,k_{30},\ k_1\,k_{10}\,k_{45} == k_2\,k_9\,k_{46},$$
$$k_{14}\,k_{25}\,k_{61} == k_{13}\,k_{26}\,k_{62},\ k_{36}\,k_{37}\,k_{60} == k_{35}\,k_{38}\,k_{59},\ k_{34}\,k_{37}\,k_{50} == k_{33}\,k_{38}\,k_{49},$$
$$k_8\,k_9\,k_{54} == k_7\,k_{10}\,k_{53},\ k_4\,k_{21}\,k_{26}\,k_{27} == k_3\,k_{22}\,k_{25}\,k_{28},\ k_4\,k_{20}\,k_{21}\,k_{37} == k_3\,k_{19}\,k_{22}\,k_{38},$$
$$k_1\,k_{10}\,k_{14}\,k_{49} == k_2\,k_9\,k_{13}\,k_{50},\ k_{20}\,k_{21}\,k_{25}\,k_{59} == k_{19}\,k_{22}\,k_{26}\,k_{60},$$
$$k_4\,k_{14}\,k_{21}\,k_{39} == k_3\,k_{13}\,k_{22}\,k_{40},\ k_1\,k_3\,k_{10}\,k_{47} == k_2\,k_4\,k_9\,k_{48},$$
$$k_1\,k_{10}\,k_{26}\,k_{55} == k_2\,k_9\,k_{25}\,k_{56},\ k_4\,k_9\,k_{20}\,k_{21}\,k_{31} == k_3\,k_{10}\,k_{19}\,k_{22}\,k_{32},$$
$$k_1\,k_3\,k_{10}\,k_{22}\,k_{51} == k_2\,k_4\,k_9\,k_{21}\,k_{52},\ k_1^2\,k_3\,k_{10}^2\,k_{19}\,k_{22}\,k_{26}\,k_{41} == k_2^2\,k_4\,k_9^2\,k_{20}\,k_{21}\,k_{25}\,k_{42},$$
$$k_1\,k_3\,k_{10}^2\,k_{19}\,k_{22}\,k_{26}\,k_{43} == k_2\,k_4\,k_9^2\,k_{20}\,k_{21}\,k_{25}\,k_{44},$$
$$k_2\,k_4\,k_9\,k_{20}\,k_{21}\,k_{25}\,k_{57} == k_1\,k_3\,k_{10}\,k_{19}\,k_{22}\,k_{26}\,k_{58}\}\}$$

```
TableForm[db,
 TableHeadings → {coevery[[Delete[reducedindices, {{2}, {6}}], 3]]}]
```

```
TableForm[Table[Complement[
    ReactionsData[coevery[[i, 2]], ExternalSpecies → "HV"]["fhjgraph"],
    ReactionsData[coevery[[j, 2]], ExternalSpecies → "HV"]["fhjgraph"]],
  {i, reducedindices}, {j, reducedindices}],
 TableHeadings → {coevery[[reducedindices, 3]], coevery[[reducedindices, 3]]}]
```

```
TableForm[Table[Length@Complement[
    ReactionsData[coevery[[i, 2]], ExternalSpecies → {"HV"}]["fhjgraph"],
    ReactionsData[coevery[[j, 2]], ExternalSpecies → "HV"]["fhjgraph"]],
  {i, reducedindices}, {j, reducedindices}], TableHeadings →
  {coevery[[reducedindices, 3]], coevery[[reducedindices, 3]]}]
```

	Ahmed2007	CRECK2012	Dagaut2003	Davis2005	gri3
Ahmed2007	0	19	12	14	2
CRECK2012	7	0	6	7	7
Dagaut2003	8	14	0	8	8
Davis2005	2	7	0	0	0
gri30	4	21	14	14	0
Keromnes2013	8	10	4	6	6
Li2007	8	24	14	20	6
Rasmussen2008	16	34	24	28	14
SanDiego2011	4	19	14	14	2
SaxenaWilliams2006	4	7	2	2	2
Starik2009	16	35	24	28	16
Sun2007	6	12	0	6	6
Zsely2005	4	9	0	2	2

Methanol combustion mechanisms

```
SetDirectory[NotebookDirectory[] <> "methanol"];
```

```
ClearAll[mdata];
mdat = Flatten[Import["names_methanol.txt", "Table"]];
mdata = StringReplace[#, ".dat" → ""] & /@ mdat
```

```
{Aranda2013, Klippenstein2011, Li2007, Rasmussen2008, ZabettaHuba2008}
```

```
indices = Range[5];
```

```
TableForm[mdata, TableHeadings → {indices, None}]
```

```
1 | Aranda2013
2 | Klippenstein2011
3 | Li2007
4 | Rasmussen2008
5 | ZabettaHuba2008
```

```
ClearAll[mall];
mall = CHEMKINImport[#]["chemkinreactions"] & /@ mdat; // AbsoluteTiming
```

```
{2.8941656, Null}
```

```
ClearAll[mevery];
mevery = Transpose[{mall, DeleteAutocatalysis /@ mall, mdata}]; //
 AbsoluteTiming
```

```
{3.2371851, Null}
```

```
TableForm[ReactionsData[#]["M", "R", "deficiency"] & /@ mevery[[indices, 2]],
 TableHeadings → {mevery[[indices, 3]], {"M", "R", "deficiency"}}]
```

	M	R	deficiency
Aranda2013	76	1063	δ=n-l-s=661-187-71=403
Klippenstein2011	18	172	δ=n-l-s=122-42-15=65
Li2007	18	170	δ=n-l-s=121-42-15=64
Rasmussen2008	28	320	δ=n-l-s=222-75-24=123
ZabettaHuba2008	58	724	δ=n-l-s=500-163-54=283

```
TableForm[ReactionsData[#]["species"] & /@ mevery[[indices, 2]],
 TableHeadings → {mevery[[indices, 3]], {"list", " of ", "species\n"}}]
```

	list	of	species			
Aranda2013	CH2OOH	CH2O	OH	C2H4	HOCH2CH2OO	CH2OH
Klippenstein2011	C2H6	CH3	CH2O	CO	H2	H
Li2007	C2H6	CH3	CH2O	CO	H2	H
Rasmussen2008	NO2	NO2*	NO	O2	CH2O	CO
ZabettaHuba2008	C2H2	C2H	H	C4H2	C2H3	C2H4

```
TableForm[Table[mevery[[i, 2]] /. x_Equilibrium → Sequence[], {i, 5}],
 TableHeadings → {mevery[[indices, 3]], None}]
```

Aranda2013	CH2OOH → CH2O + OH	C2H4 + HOCH2CH2OO → CH2O + CH2OH + CH3CHO
Klippenstein2011		
Li2007		
Rasmussen2008	NO2 → NO2*	2 NO2* → 2 NO + O2
ZabettaHuba2008		

```
mevery[[1, 2]] /. x_Equilibrium → Sequence[]
```

```
{CH2OOH → CH2O + OH, C2H4 + HOCH2CH2OO → CH2O + CH2OH + CH3CHO,
 CH2O + HOCH2CH2OO → CH2OH + CH2OOH + HCO,
 HO2 + HOCH2CH2OO → CH2OH + CH2OOH + O2, CH2CHOH + O2 → CH2O + HCO + OH}
```

```
mevery[[-2, 2]] /. x_Equilibrium → Sequence[]
```

```
{NO2 → NO2*, 2 NO2* → 2 NO + O2}
```

```
Row[{ShowFHJGraph[#[[2]], DirectedEdges → True,
       VertexLabeling → All, PlotLabel → #[[3]], ImageSize → 420], "    ",
      Column[Join[{"3rd body species deleted"}, #[[2]]]], "    ", Column[
       Join[{"Orig. Mechanism"}, #[[1]]]]} & /@ mevery[[indices]] // Timing
```

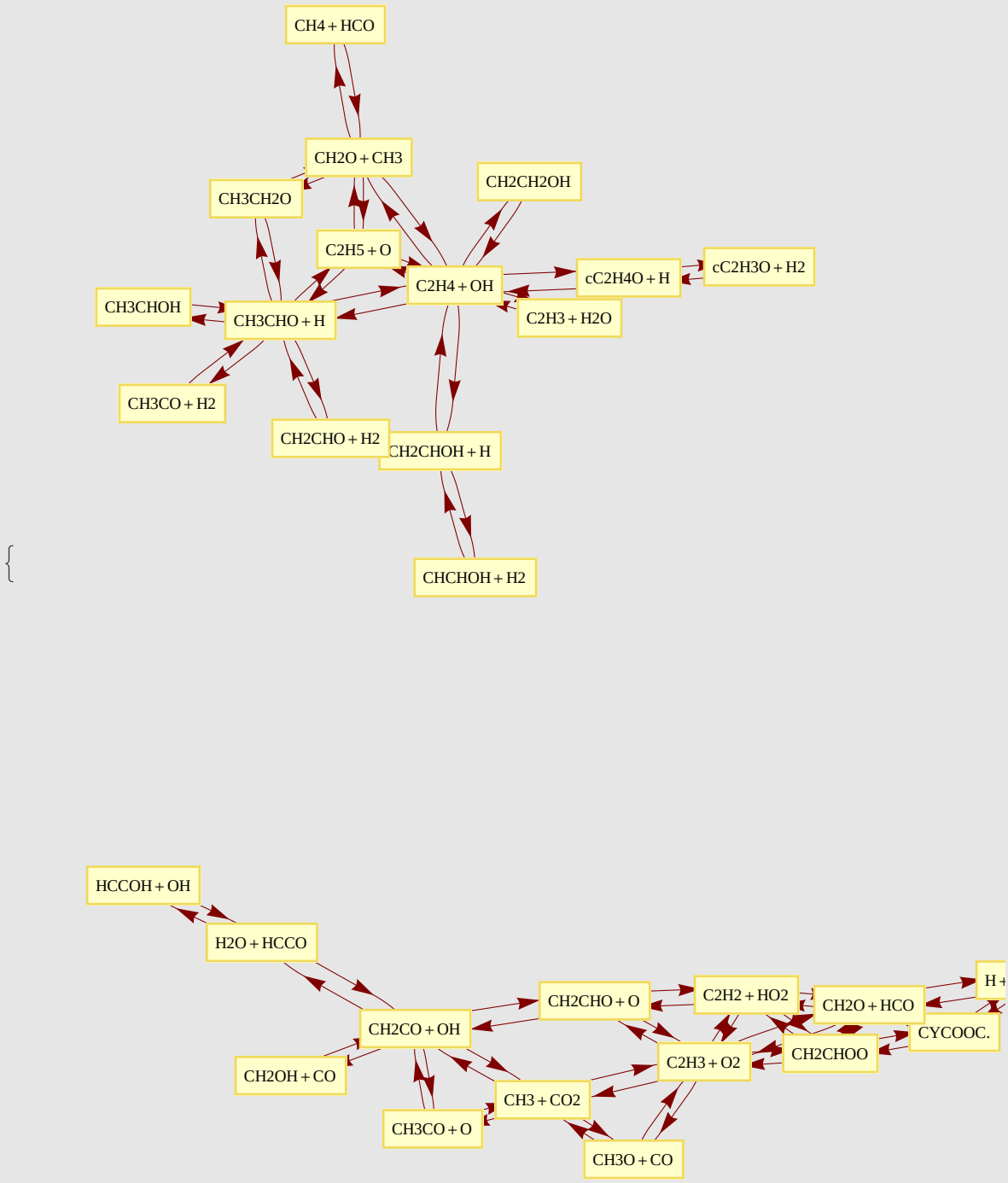
```
maxfhjcomponents = MaxFHJWeaklyConnectedComponents[mevery[[#, 2]] & /@
    indices; // AbsoluteTiming
```

```
{0.0040002, Null}
```

```
maxfhjedges = Flatten[First /@ #] & /@ maxfhjcomponents;
```

```
GraphPlot[First[#], VertexLabeling → True, DirectedEdges → True,
   ImageSize → 700, PlotLabel → "Max weakly connected component of mech " <>
     ToString[mevery[[Last[#], 3]] <> "\n"] & /@
 Transpose[{maxfhjedges, indices}]
```

Max weakly connected component of mech Aranda2013



```
TableForm[
 tt = Table[TrueQ[mevery[[i, 2]] == mevery[[j, 2]]] /. {True → Style["TRUE", Bold]},
   {i, 5}, {j, 5}], TableHeadings → {mdata, mdata}]
```

	Aranda2013	Klippenstein2011	Li2007	Rasmussen2008
Aranda2013	**TRUE**	False	False	False
Klippenstein2011	False	**TRUE**	False	False
Li2007	False	False	**TRUE**	False
Rasmussen2008	False	False	False	**TRUE**
ZabettaHuba2008	False	False	False	False

```
ag = (tt /. {Style["TRUE", Bold] → 1, False → 0}) - IdentityMatrix[5];
```

```
AdjacencyGraph[ag, ImageSize → 550, ImagePadding → 60, VertexLabels →
  Thread[Rule[indices, Style[#, Bold, 12] & /@ mevery[[indices, 3]]]]]
```


```
reducedindices = Sort[First /@ ConnectedComponents[AdjacencyGraph[ag]]]
```

```
{1, 2, 3, 4, 5}
```

```
Column[Riffle[Row /@
    (Join[{Style[mevery[[#, 3]], Bold, 14], "\t"}, VolpertIndexing[mevery[[#, 2]],
        {"CH2O"}, Verbose → True]] & /@ reducedindices), "\n\n"], 2]
```

```
Column[
 Riffle[Row /@ (Join[{Style[mevery[[#, 3]], Bold, 14], "\t"}, VolpertIndexing[
        mevery[[#, 2]], {"CH3OH", "O2", "N2"},
        Verbose → True]] & /@ reducedindices), "\n\n"], 2]
```

```
ShowVolpertGraph[mevery[[3, 2]], PlotFunction → "LayeredGraphPlot",
 DirectedEdges → True, VertexLabeling → True, ImageSize → 1000,
 PlotLabel → Style["Volpert graph of " <> mevery[[3, 3]], 15, Bold, Black],
 EdgeLabeling → True, Numbered → True, Indexed → {"CH3OH", "O2", "N2"},
 MultiedgeStyle → True, PlotRangeClipping → True]
```

```
ReversibleQ /@ mevery[[reducedindices, 2]]
```

```
{False, True, True, False, True}
```

```
db = Sort[DetailedBalanced[#], Total[Length /@ (#1 /. Equal → List)] <
        Total[Length /@ (#2 /. Equal → List)] &] & /@
    mevery⟦Delete[reducedindices, {{1}, {4}}], 2⟧; // AbsoluteTiming
```

```
{14.5088299, Null}
```

```
TableForm[db, TableHeadings → {mevery⟦Delete[reducedindices, {{1}, {4}}], 3⟧}]
```

Klippenstein2011	$k_6\, k_7\, k_{11} == k_5\, k_8\, k_{12}$	$k_8\, k_{14}\, k_{15} == k_7\, k_{13}\, k_{16}$	$k_9^2\, k_{14}\, k_{21} == k_1^2$
Li2007	$k_6\, k_7\, k_{11} == k_5\, k_8\, k_{12}$	$k_8\, k_{14}\, k_{15} == k_7\, k_{13}\, k_{16}$	$k_9^2\, k_{14}\, k_{21} == k_1^2$
ZabettaHuba2008	$k_{17}\, k_{24}\, k_{27} == k_{18}\, k_{23}\, k_{28}$	$k_{18}\, k_{50}\, k_{51} == k_{17}\, k_{49}\, k_{52}$	$k_{39}^2\, k_{44}\, k_{71} == k$

```
TableForm[Table[Complement[ReactionsData[mevery⟦i, 2⟧]["fhjgraph"],
   ReactionsData[mevery⟦j, 2⟧]["fhjgraph"]],
  {i, reducedindices}, {j, reducedindices}],
 TableHeadings → {mevery⟦reducedindices, 3⟧, mevery⟦reducedindices, 3⟧}]
```

```
TableForm[Table[Length@Complement[ReactionsData[mevery⟦i, 2⟧]["fhjgraph"],
    ReactionsData[mevery⟦j, 2⟧]["fhjgraph"]],
  {i, reducedindices}, {j, reducedindices}],
 TableHeadings → {mevery⟦reducedindices, 3⟧, mevery⟦reducedindices, 3⟧}]
```

	Aranda2013	Klippenstein2011	Li2007	Rasmussen2008
Aranda2013	0	897	899	759
Klippenstein2011	6	0	2	8
Li2007	6	0	0	6
Rasmussen2008	16	156	156	0
ZabettaHuba2008	398	570	570	524