

# Summary

October 7, 2024

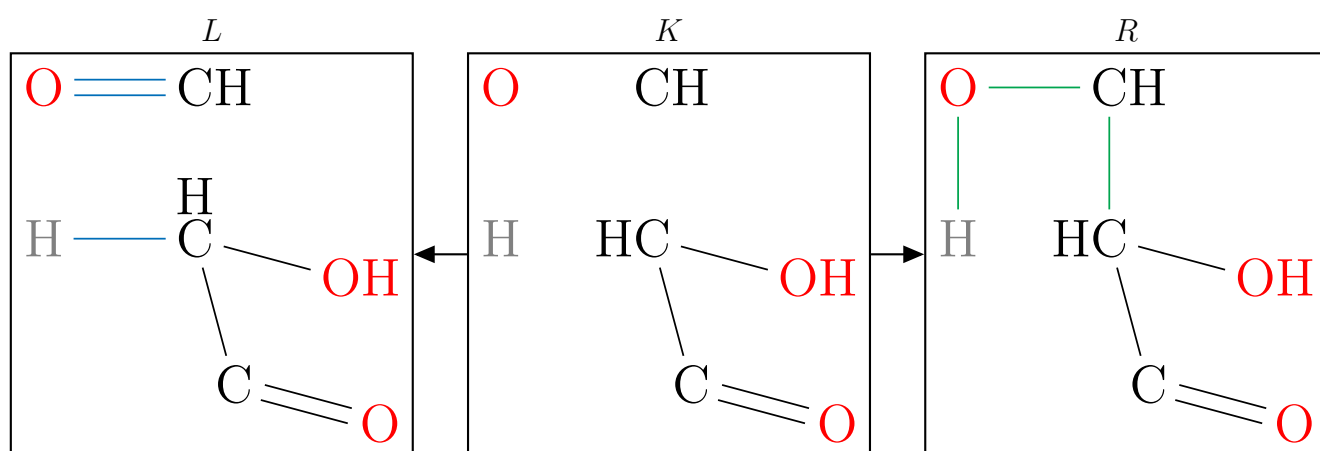
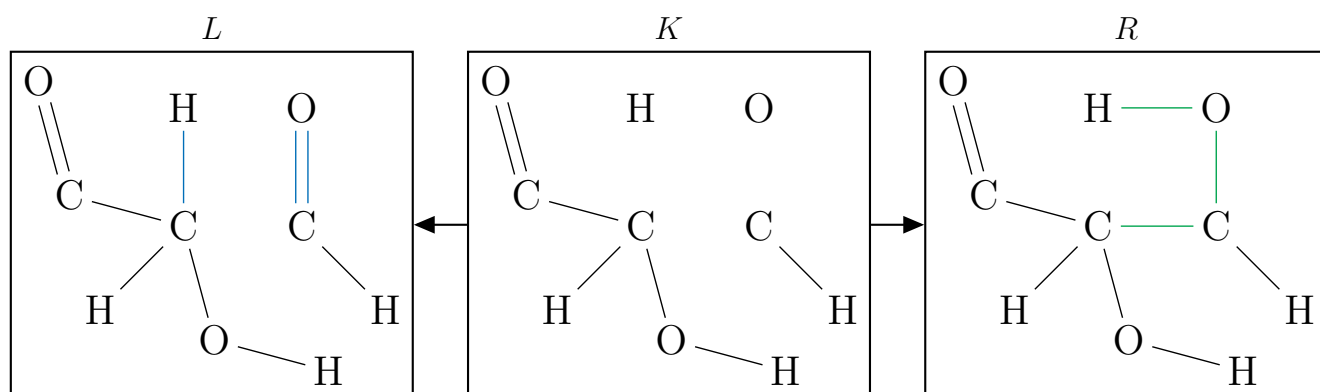
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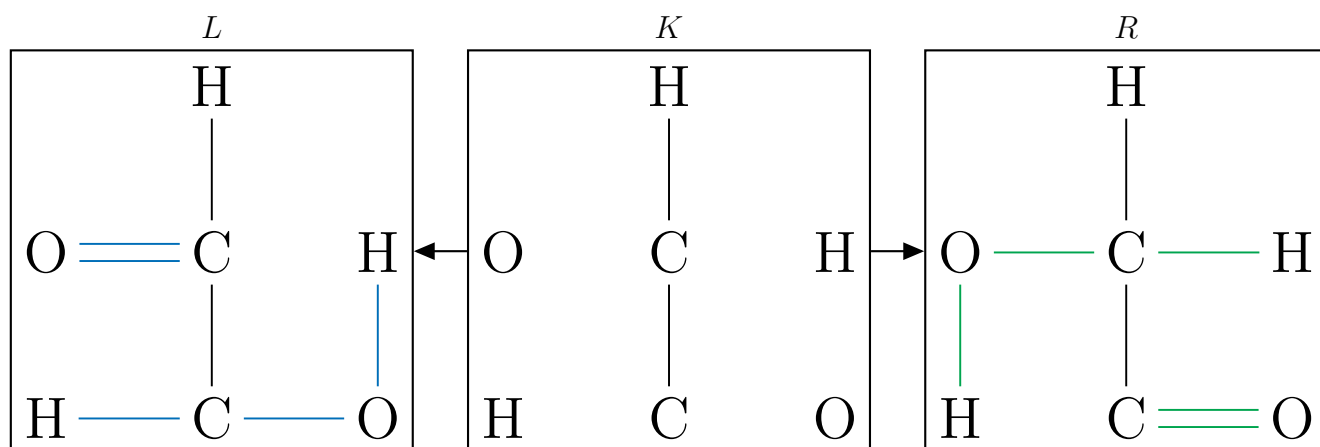
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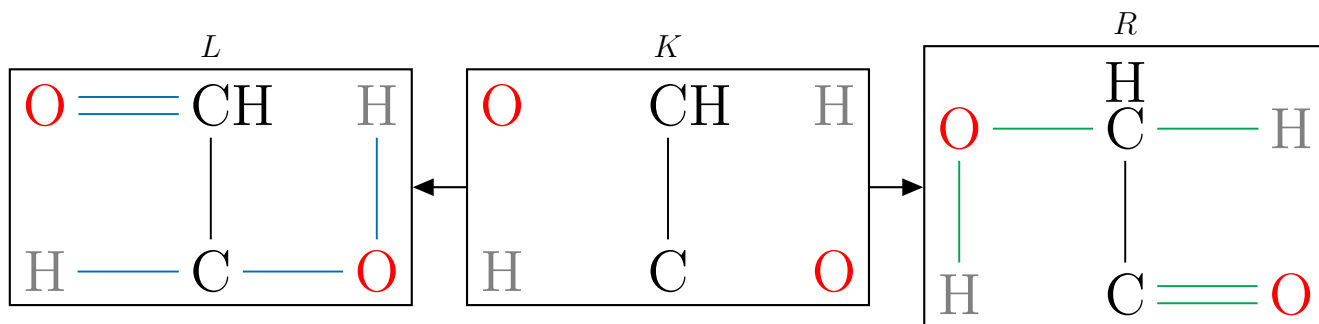
## 0.1 Loaded Rules

### 0.1.1 AL



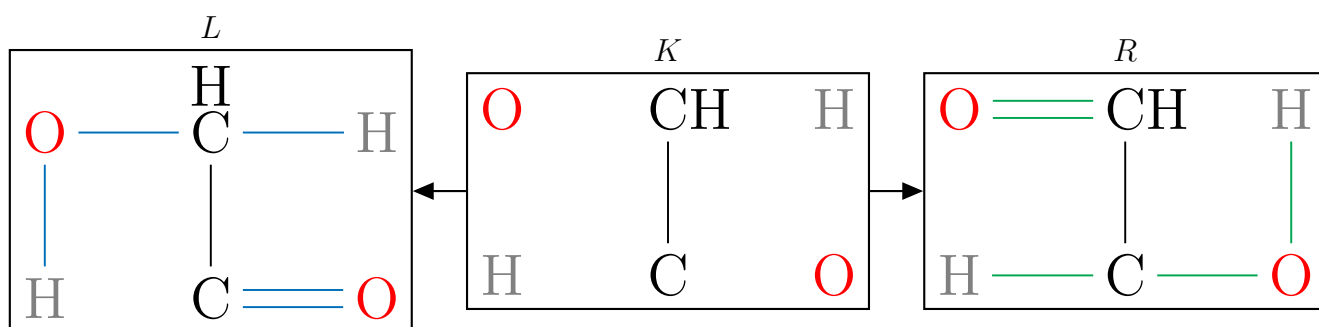
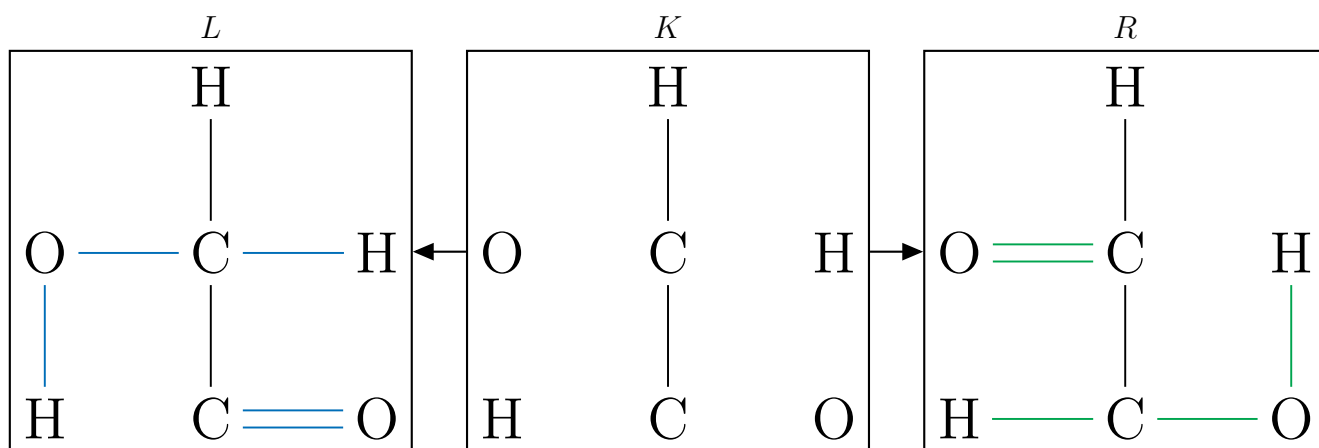
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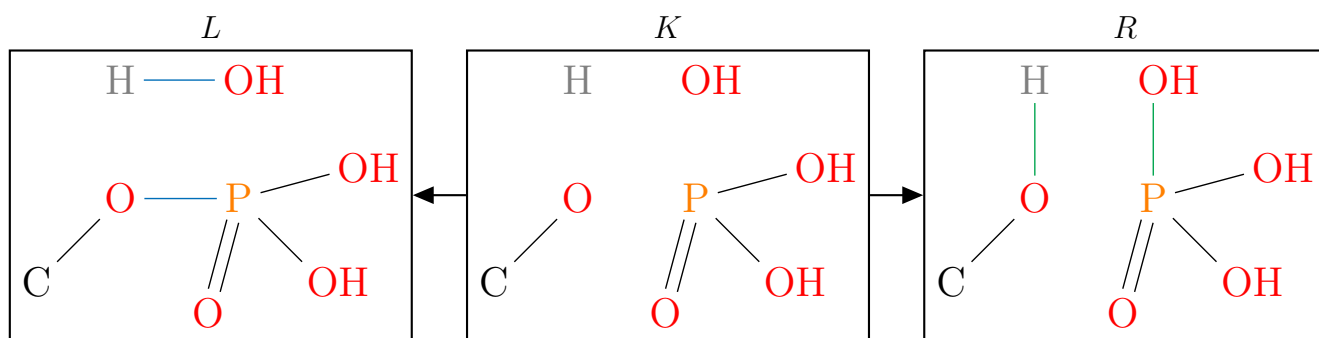
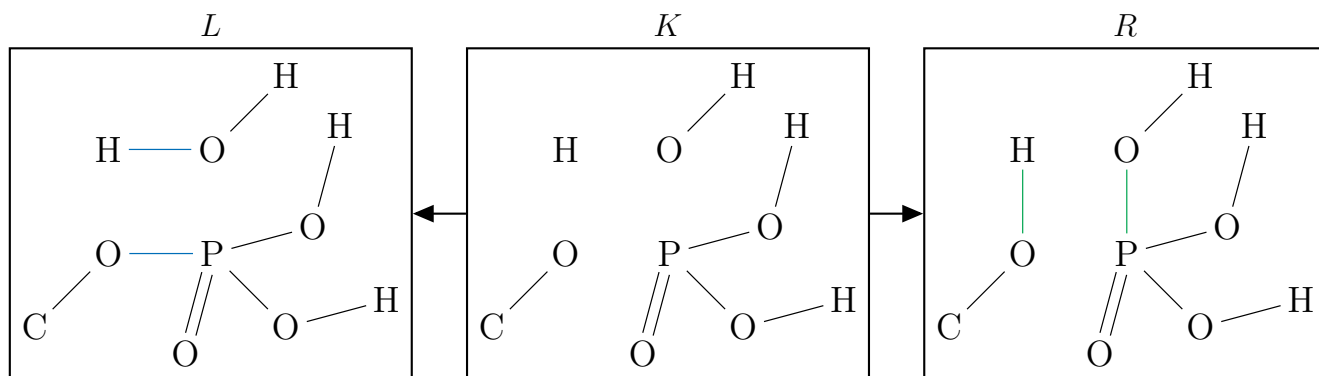
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### 0.1.3 KeAl

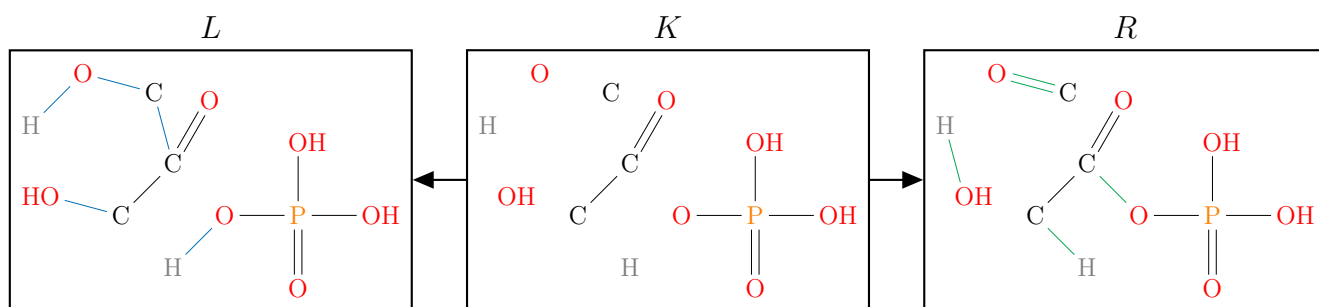
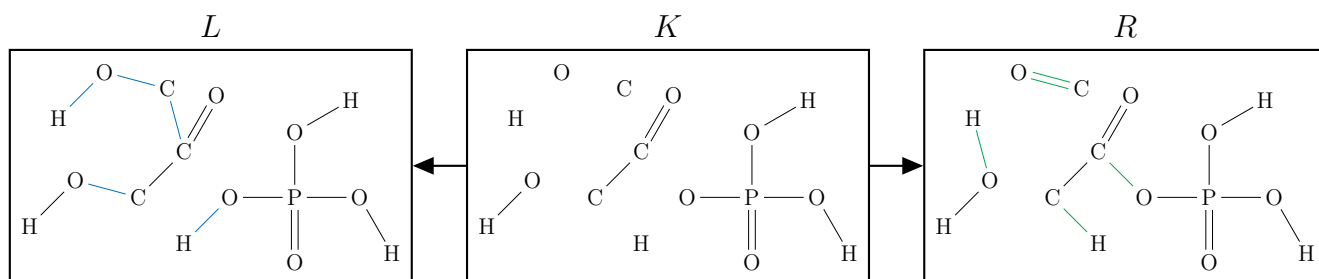


$$|\{e \in \text{outEdges}(1) \mid \text{label}(\text{target}(e)) \in \{\text{'0'}\}\}| = 1$$

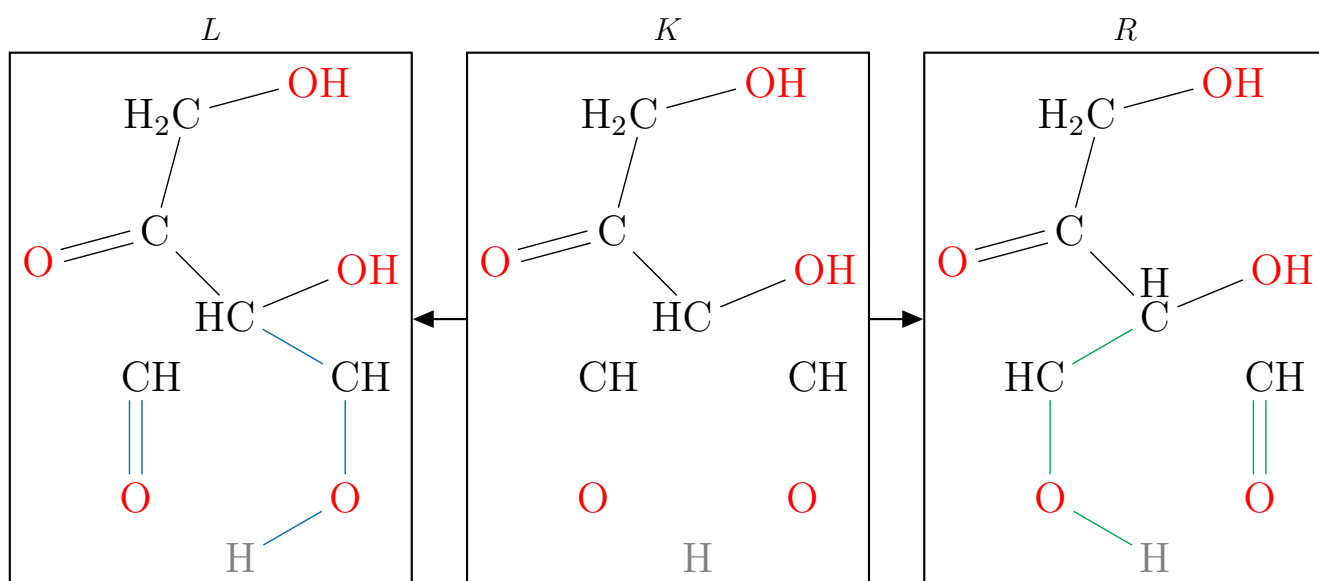
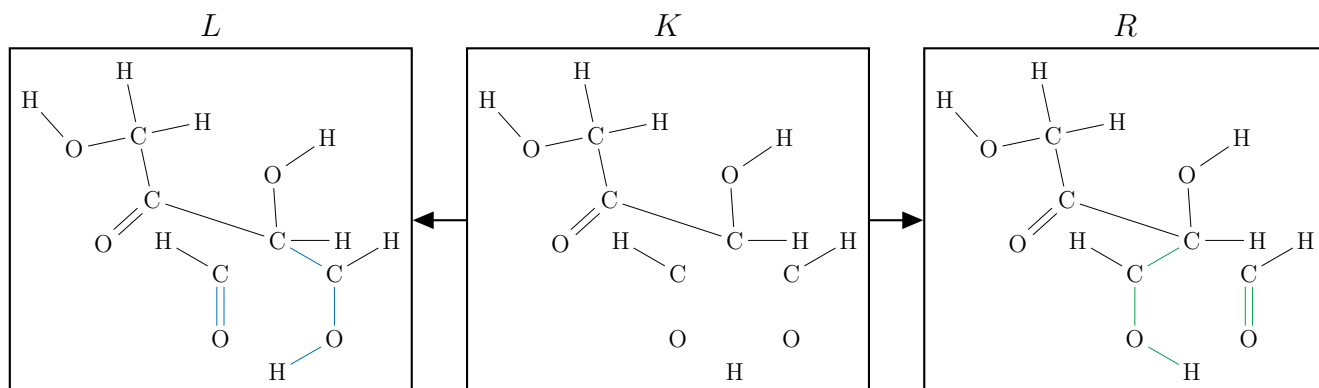
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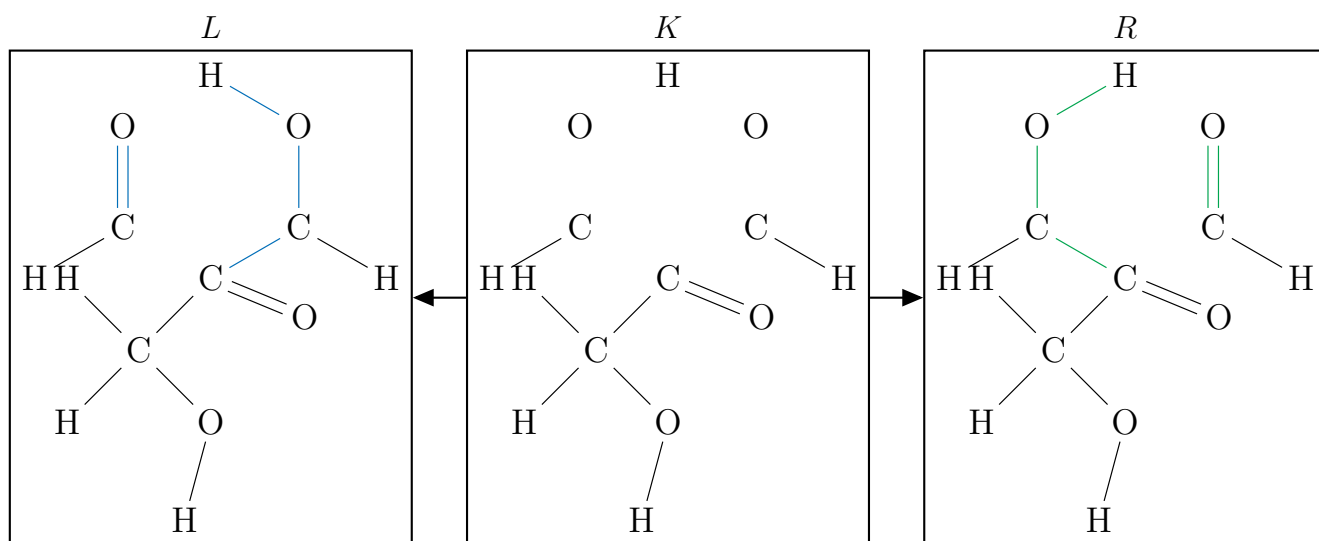
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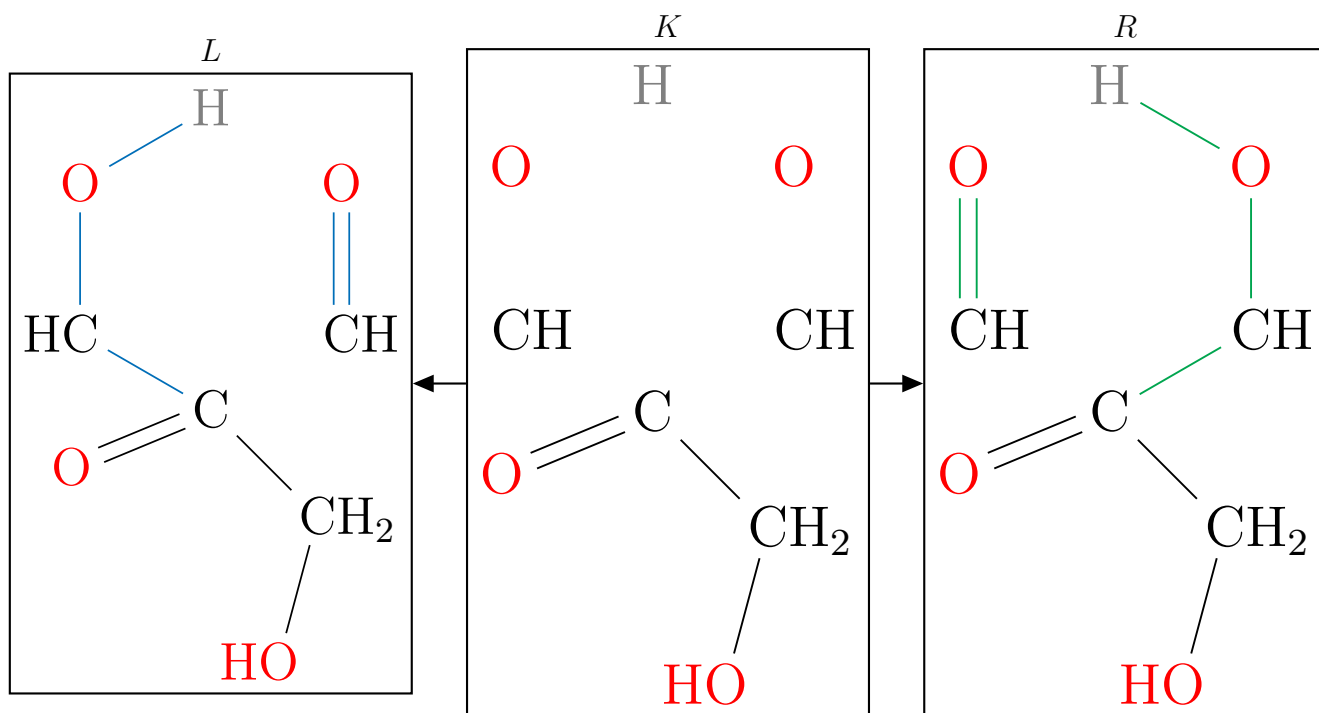


## 0.1.6 TAL

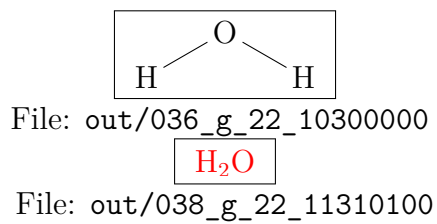


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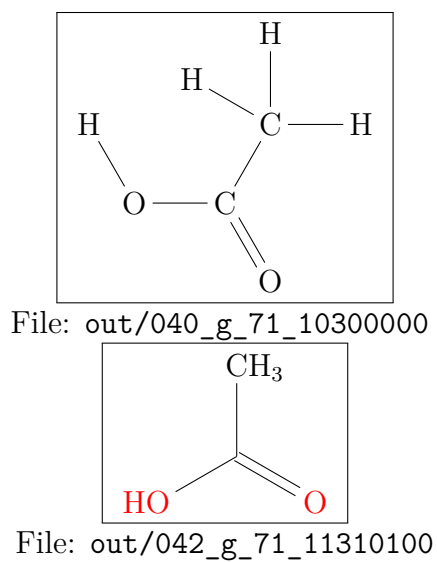




### 0.1.8 H<sub>20</sub>

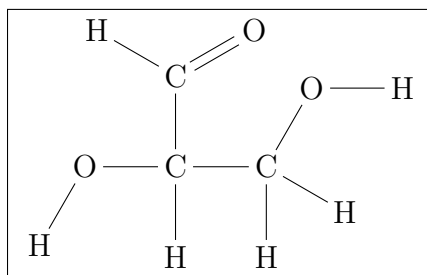


### 0.1.9 p<sub>{0,6}</sub>

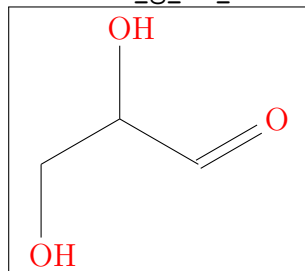




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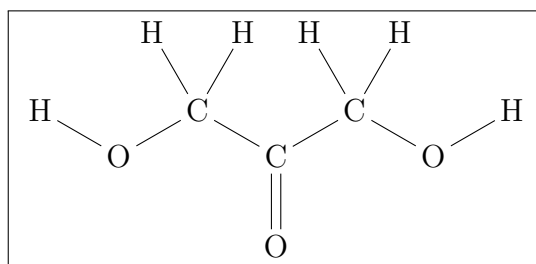


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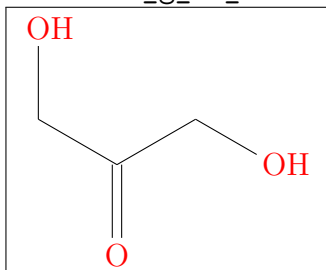


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### 0.1.11 p\_{0,8}

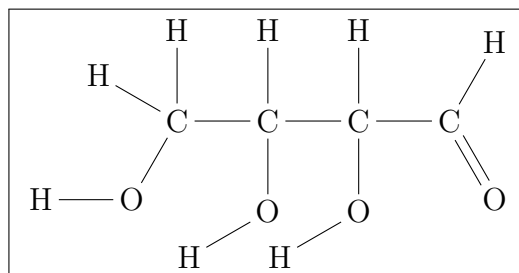


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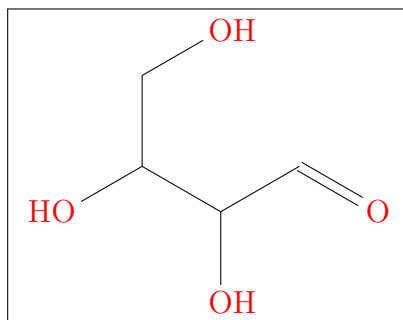


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### 0.1.12 p\_{0,9}

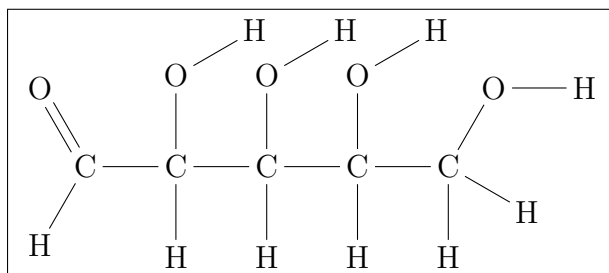


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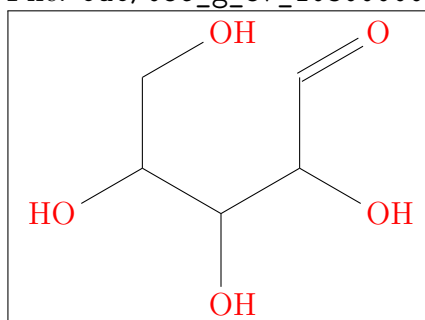


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### 0.1.13 $p_{\{0,10\}}$

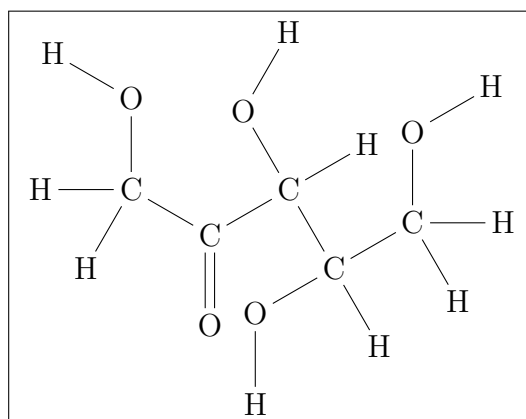


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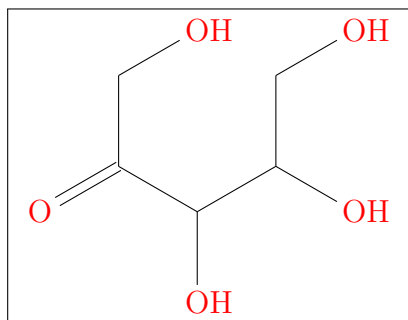


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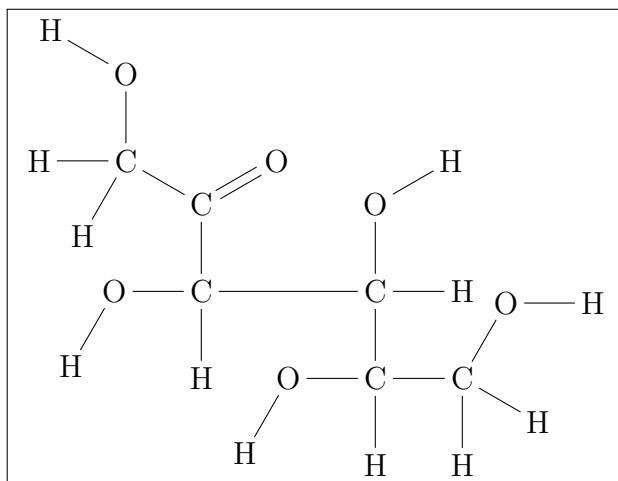


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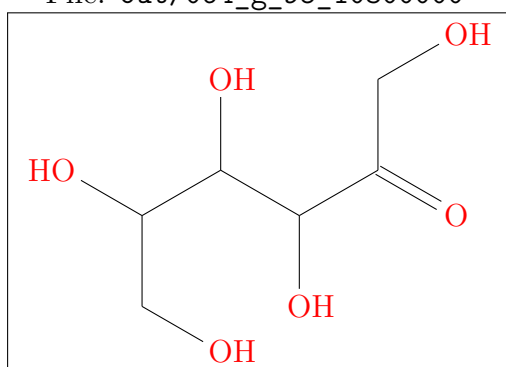


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### 0.1.15 p\_{0,12}

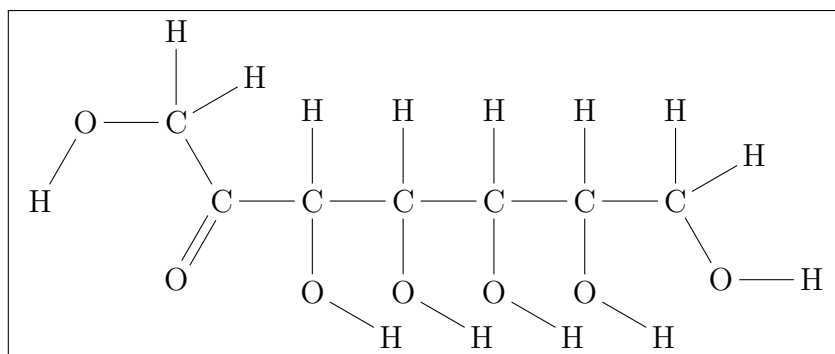


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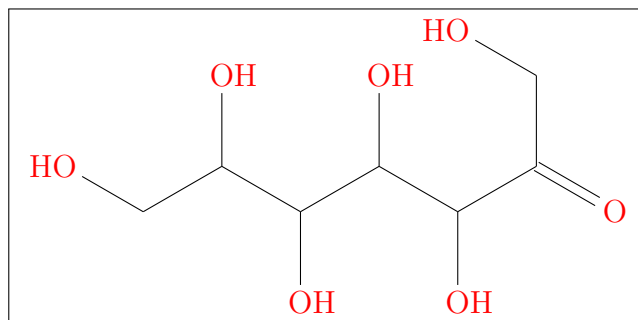


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### 0.1.16 p\_{0,13}

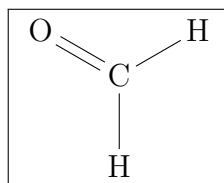


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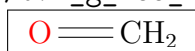


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0.1.17 p\_{0,17}

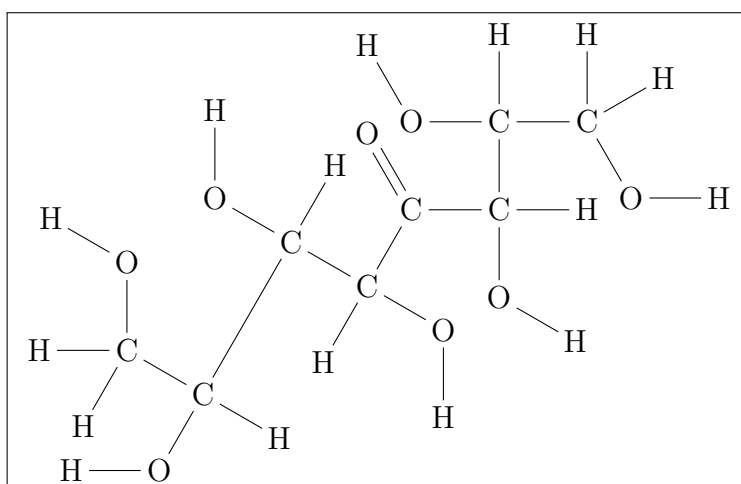


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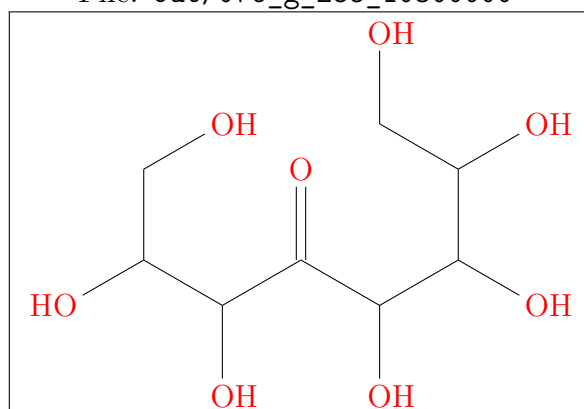


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0.1.18 p\_{0,27}

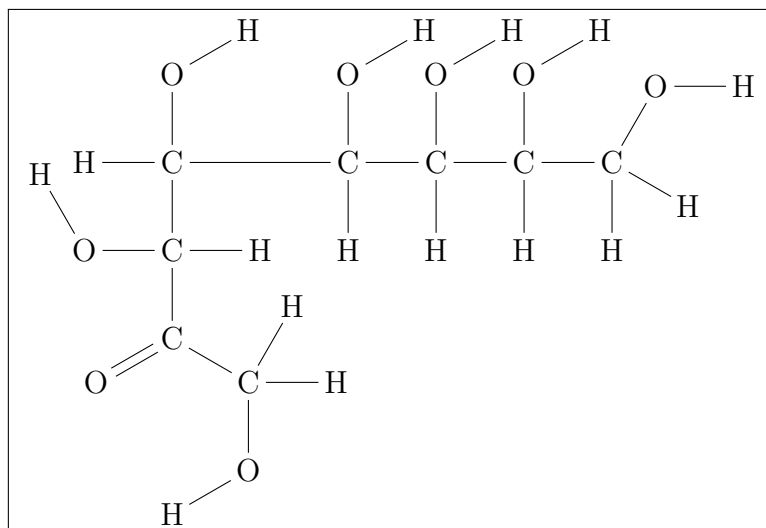


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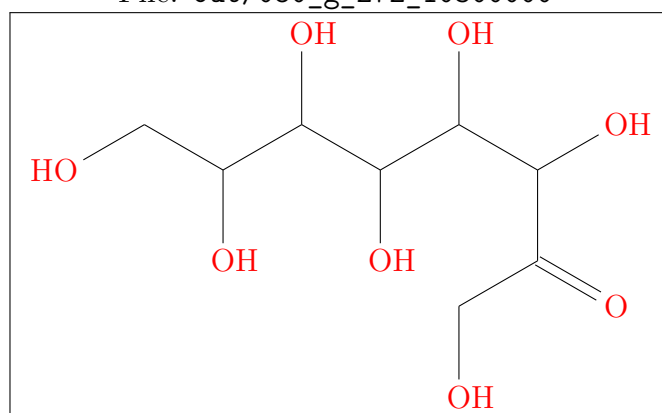


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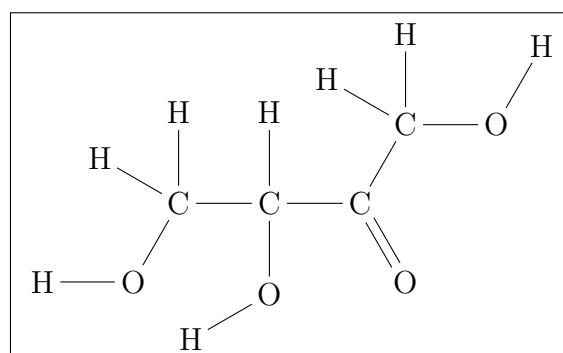


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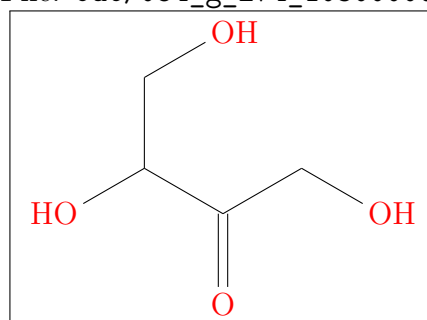


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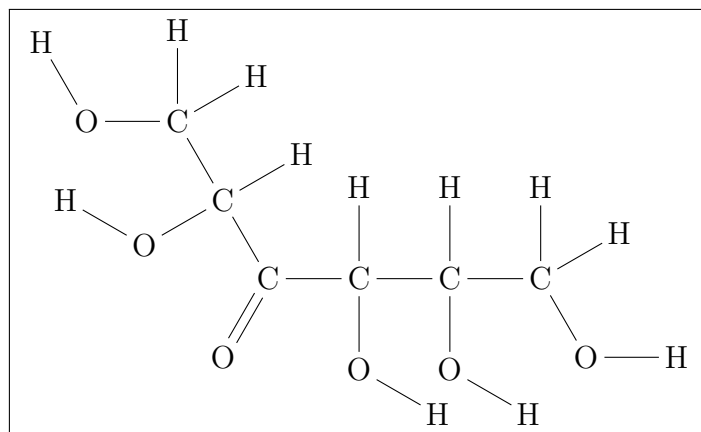


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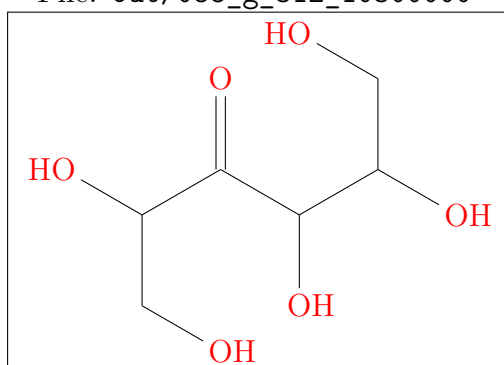


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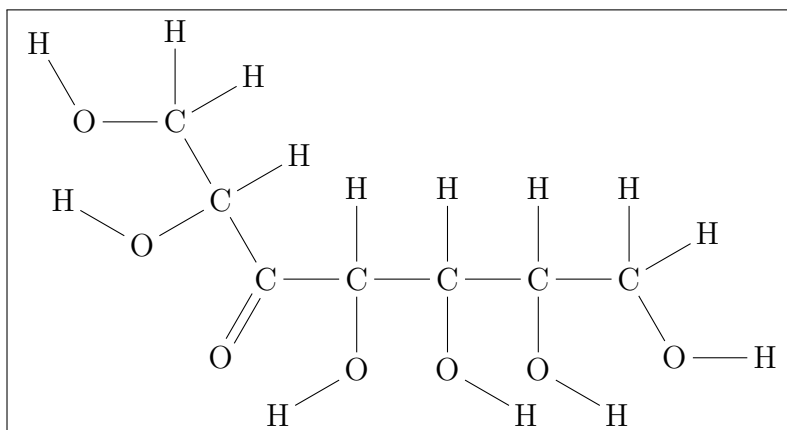


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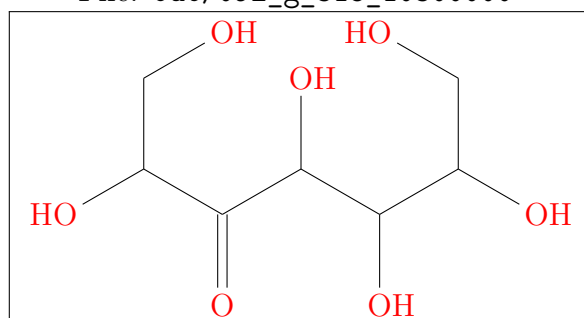


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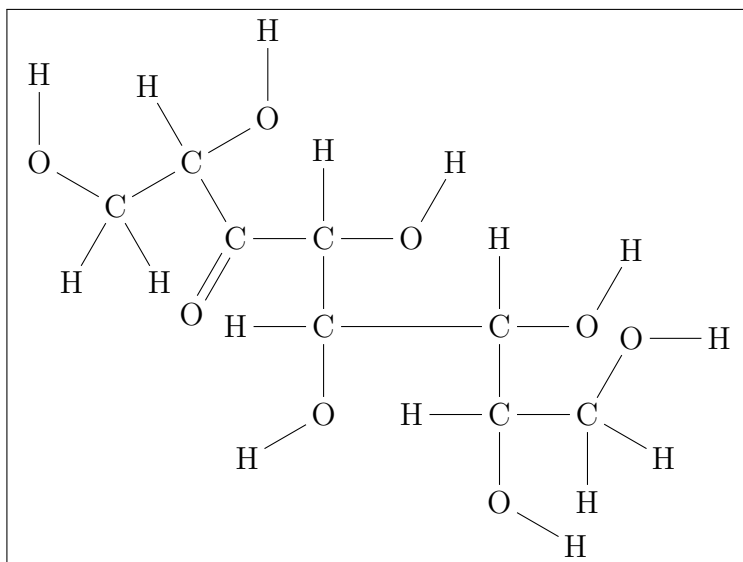


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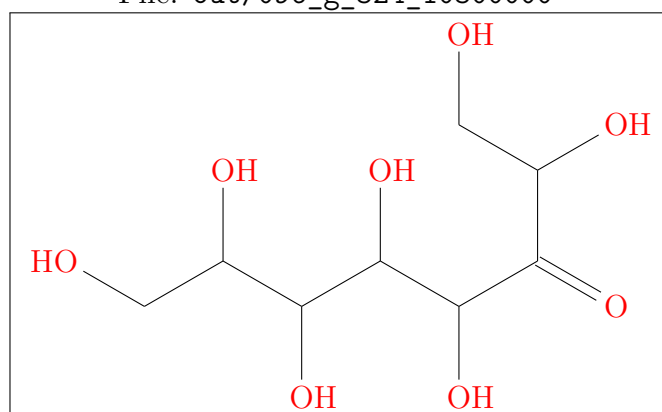


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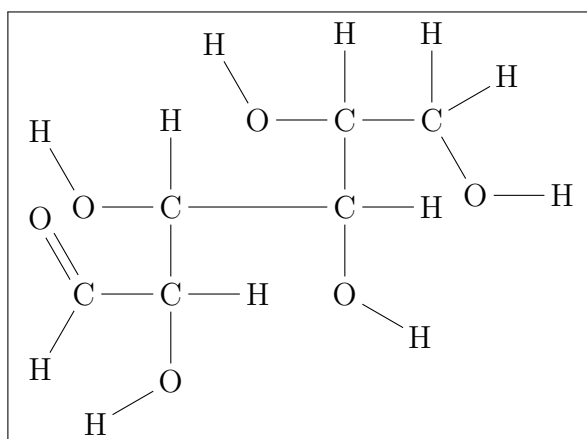


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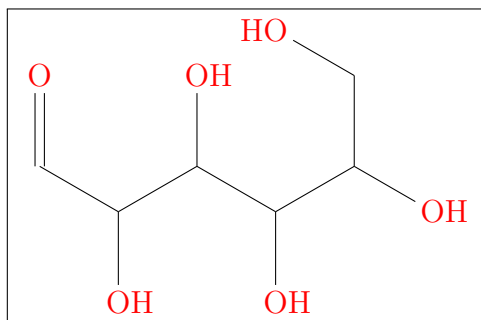


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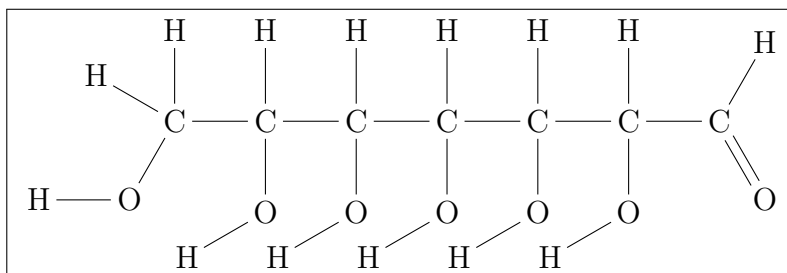


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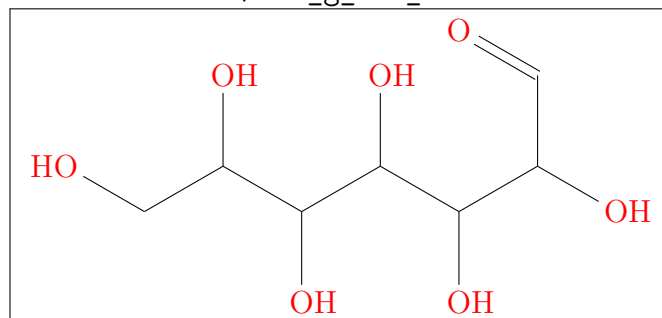


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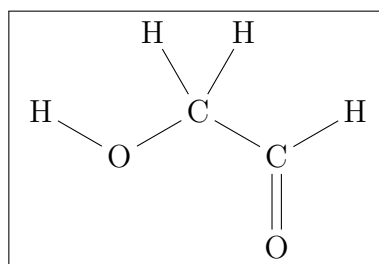


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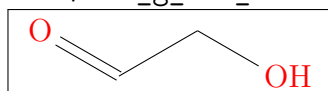


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### 0.1.26 $p_{\{0,47\}}$



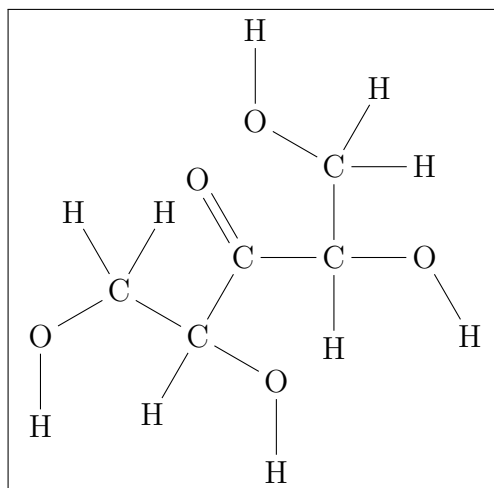
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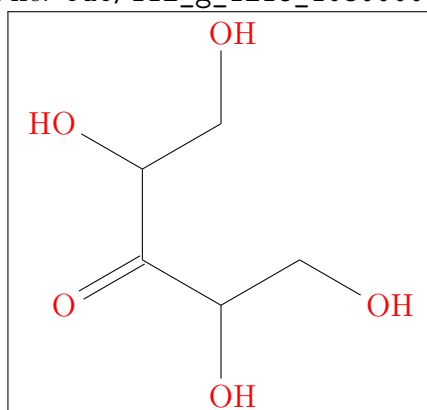
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0.1.27 p\_{0,56}

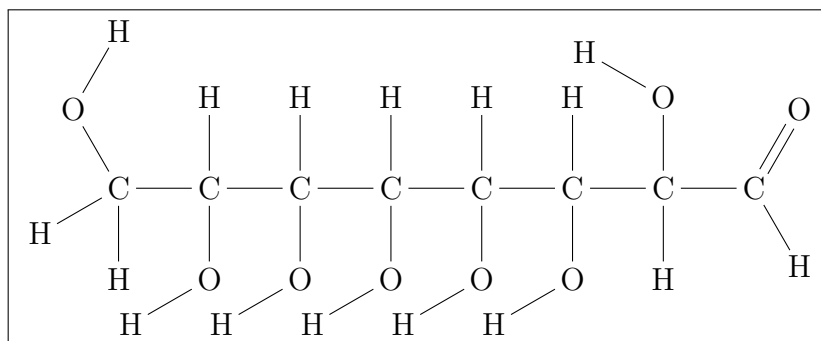


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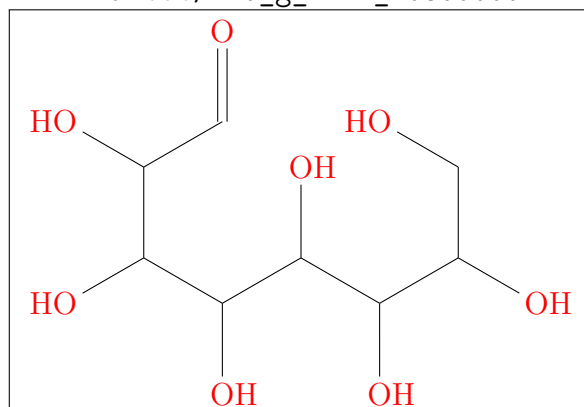


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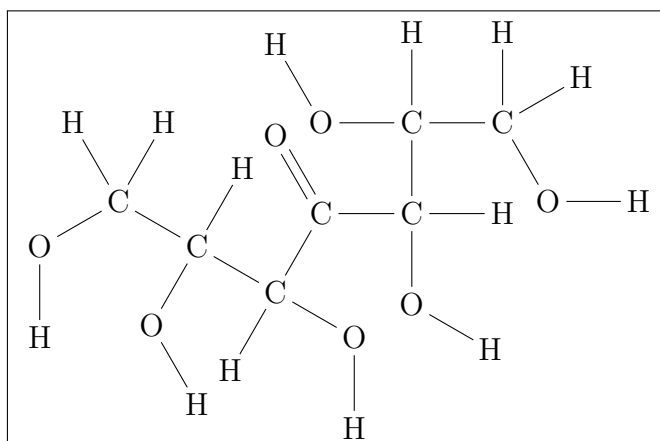


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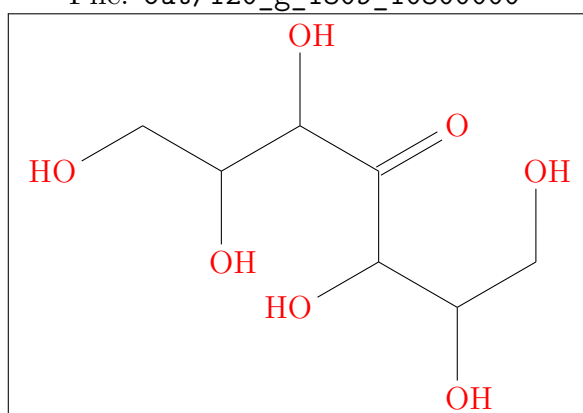


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0.1.29  $p_{\{0,60\}}$

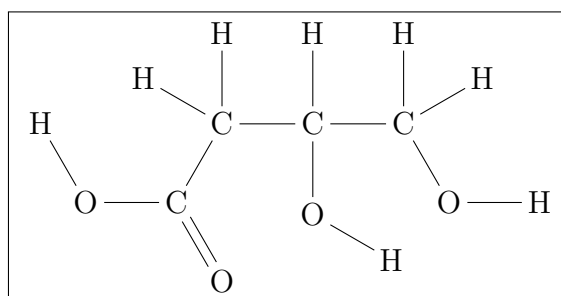


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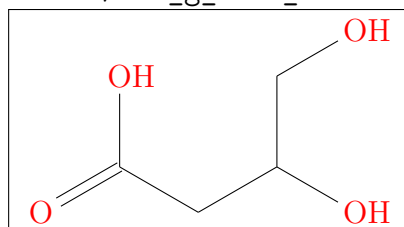


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0.1.30  $p_{\{0,61\}}$

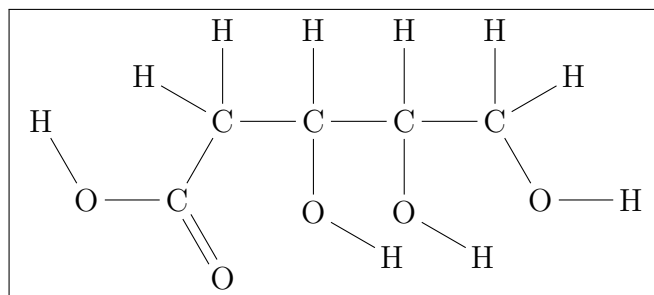


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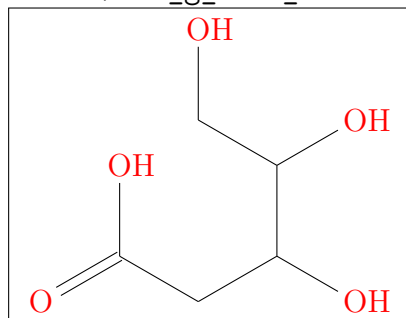


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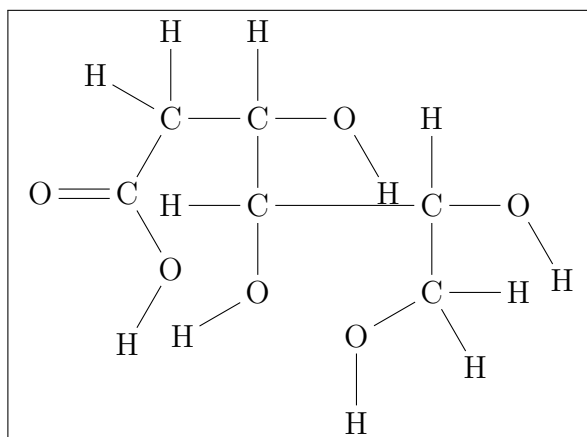


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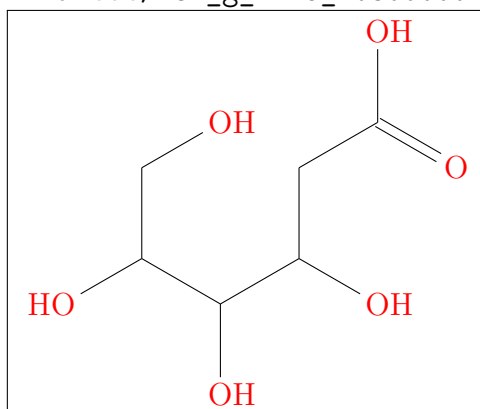


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### 0.1.32 p\_{0,63}

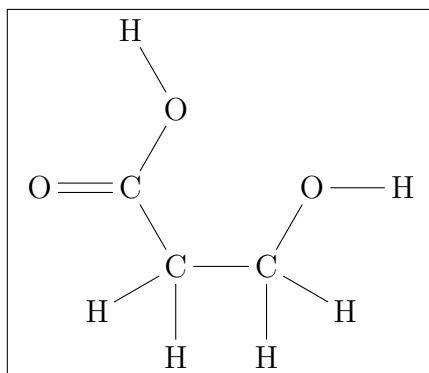


File: out/132\_g\_1445\_10300000

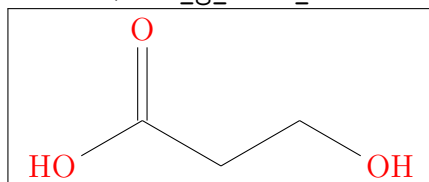


File: out/134\_g\_1445\_11310100

### 0.1.33 p\_{0,68}

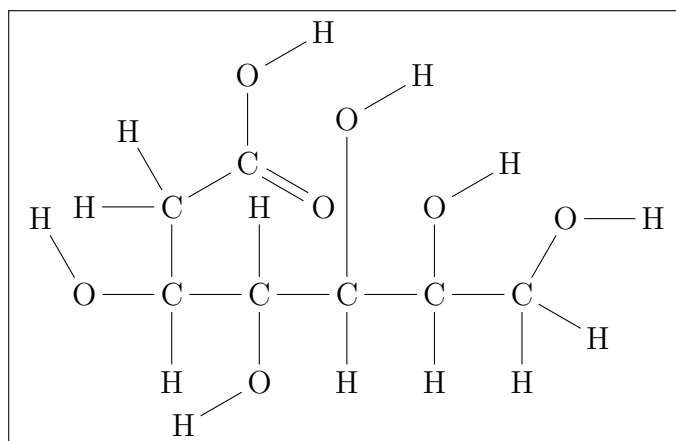


File: out/136\_g\_2596\_10300000

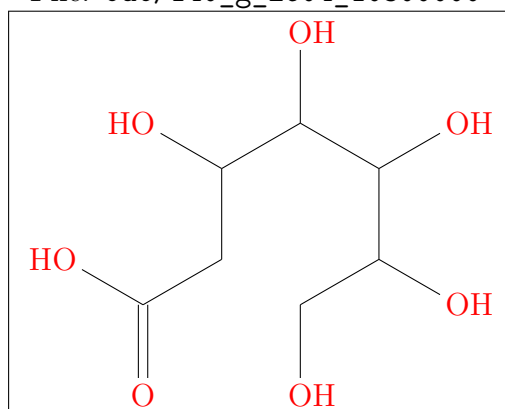


File: out/138\_g\_2596\_11310100

### 0.1.34 p\_{0,69}



File: out/140\_g\_2604\_10300000



File: out/142\_g\_2604\_11310100

## 0.2 Derivation Graph

### 0.2.1 DG Hyper, dg\_0

Figure too large, see out/143\_dg\_0\_11100\_coord.pdf

File: out/279\_dg\_0\_11100

$|V| = 81$   
 $|E| = 414$

## 0.3 Enumerated Flows with 7 reactions

## 0.4 Enumerated Flows with 7 unique reactions

### 0.4.1 Solution 0

#### Overall Data

Objective value (integral): 7

Vertex/Graph	In	Out
--------------	----	-----

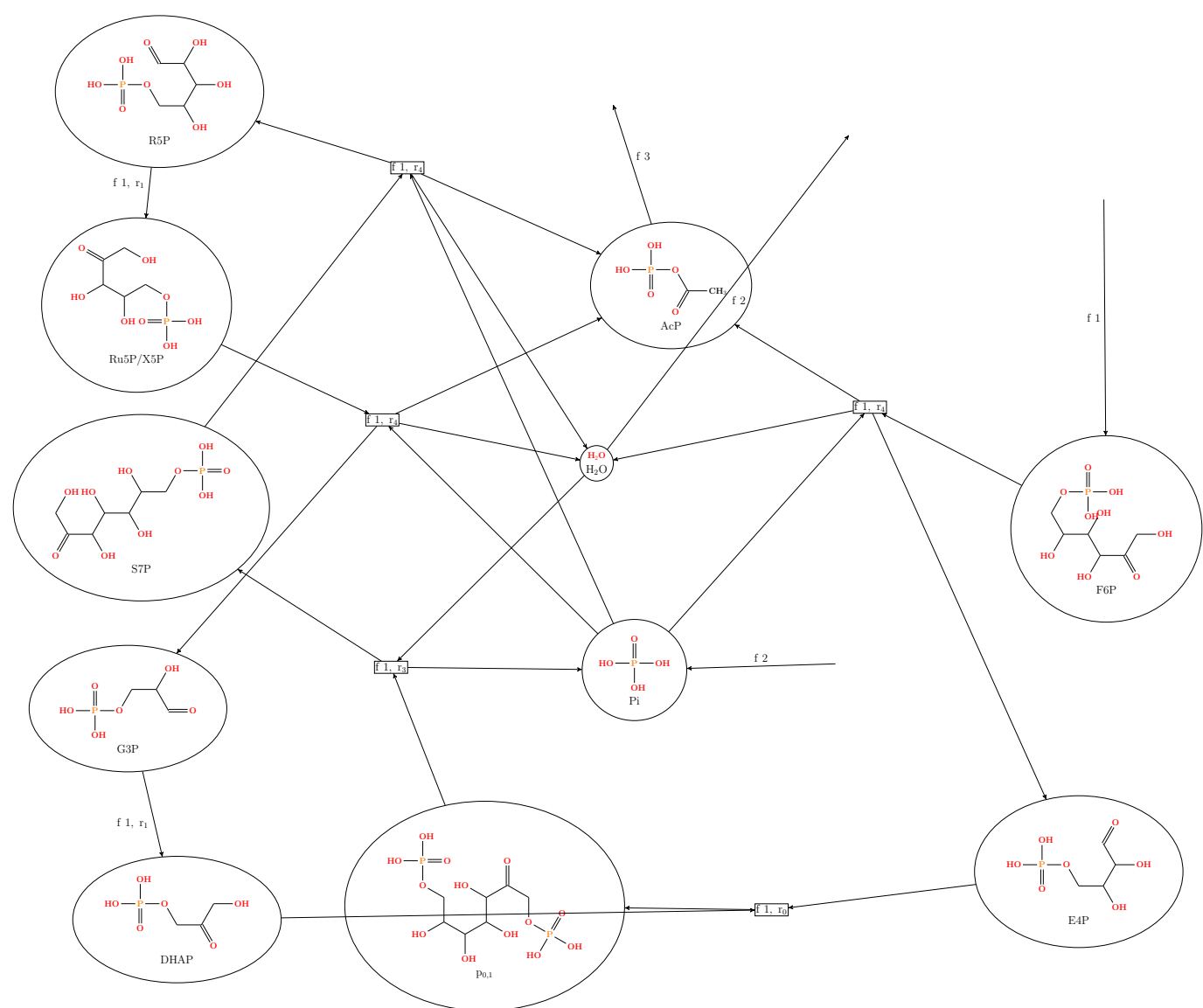
AcP	0	3
-----	---	---

F6P	1	0
-----	---	---

H_20	0	2
------	---	---

Pi	2	0
----	---	---

Filtered Graph



File: out/284\_dg\_0\_11100\_f\_0\_0\_filt

$|E| = 7 \quad |P| = 7$

0.4.2 Solution 1

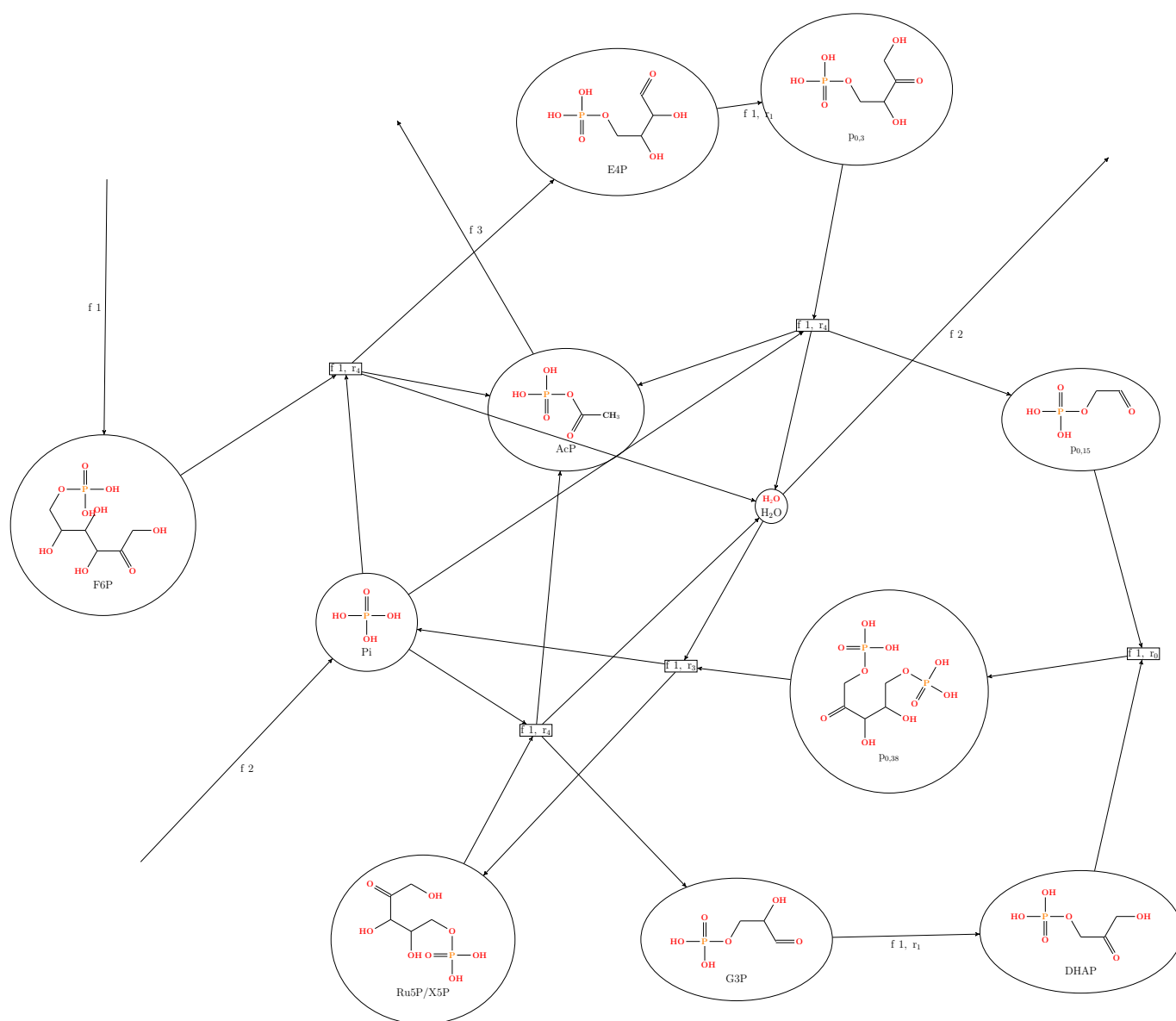
Overall Data

Objective value (integral): 7

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

## Filtered Graph



File: out/289\_dg\_0\_11100\_f\_0\_1\_filt

$$|E| = 7 \quad |P| = 7$$

- 0.5 Enumerated Flows with 8 unique reactions
- 0.6 Enumerated Flows with 9 unique reactions
- 0.7 Enumerated Flows with 10 unique reactions
- 0.8 Enumerated Flows with 11 unique reactions
- 0.9 Enumerated Flows with 8 reactions
- 0.10 Enumerated Flows with 7 unique reactions

#### 0.10.1 Solution 5

##### Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
--------------	----	-----

AcP	0	3
-----	---	---

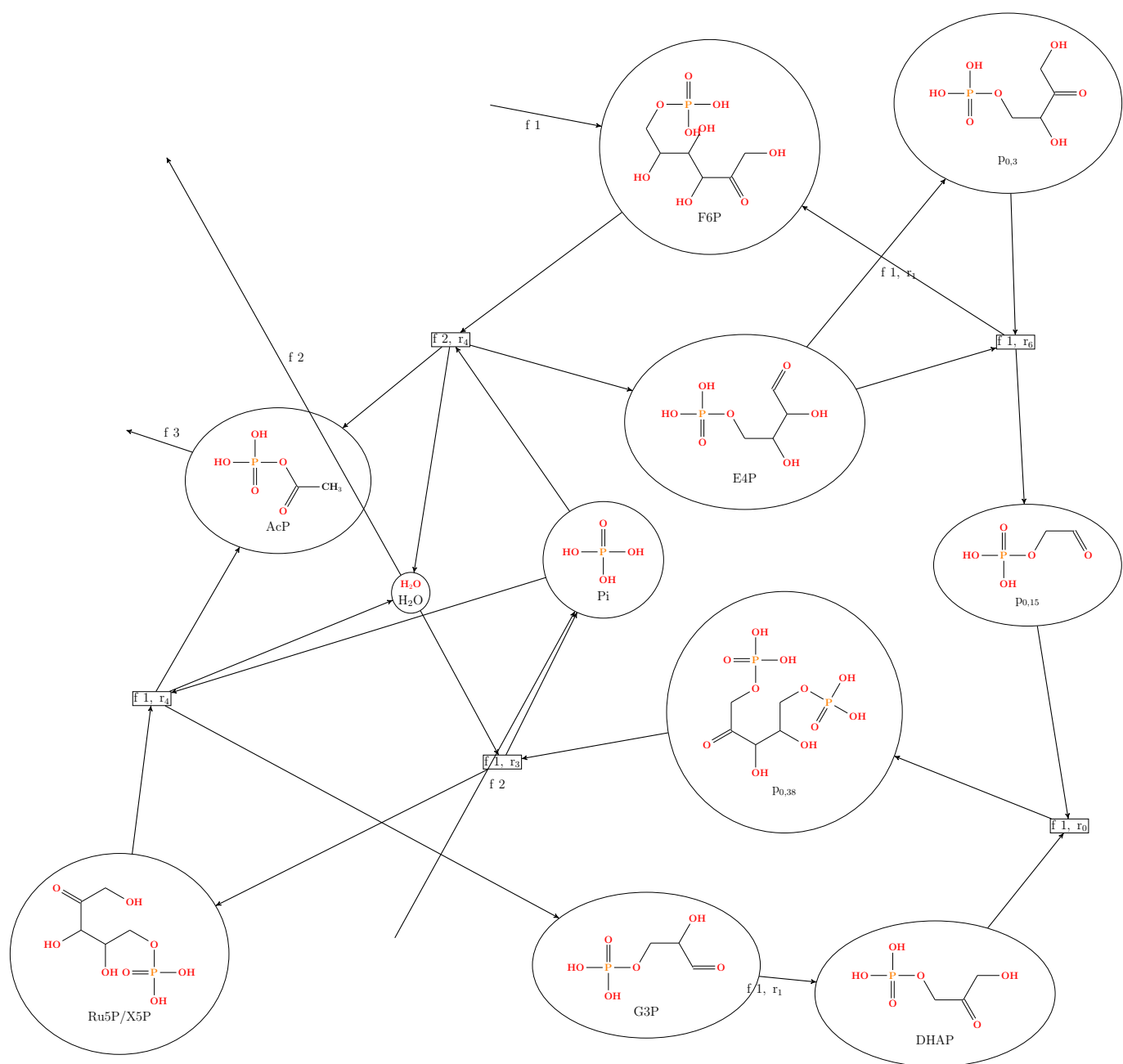
F6P	1	0
-----	---	---

H_20	0	2
------	---	---

Pi	2	0
----	---	---



Filtered Graph



File: out/294\_dg\_0\_11100\_f\_0\_5\_filt

$|E| = 7 \quad |P| = 8$

0.10.2 Solution 7

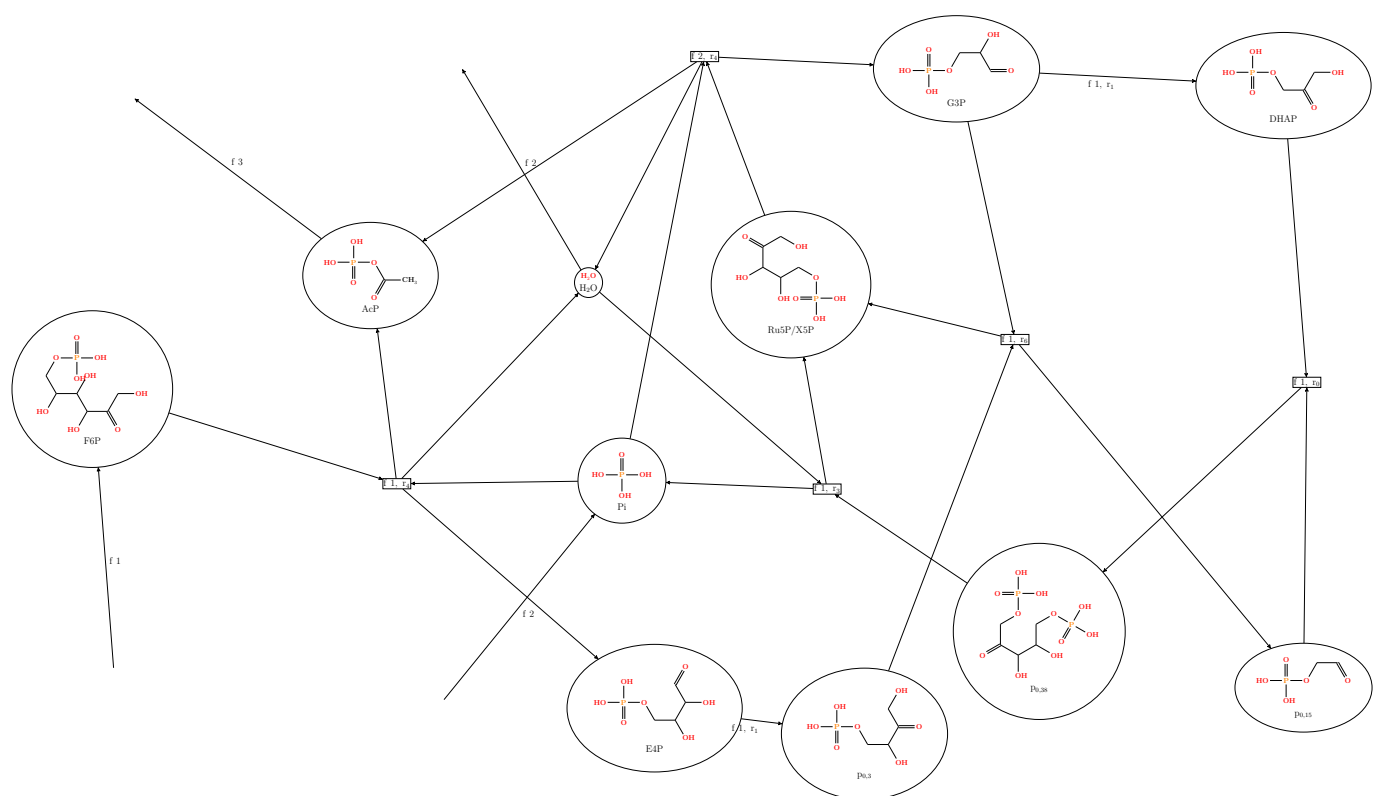
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

Filtered Graph



File: out/299\_dg\_0\_11100\_f\_0\_7\_filt

$|E| = 7 \quad |P| = 8$

0.10.3 Solution 8

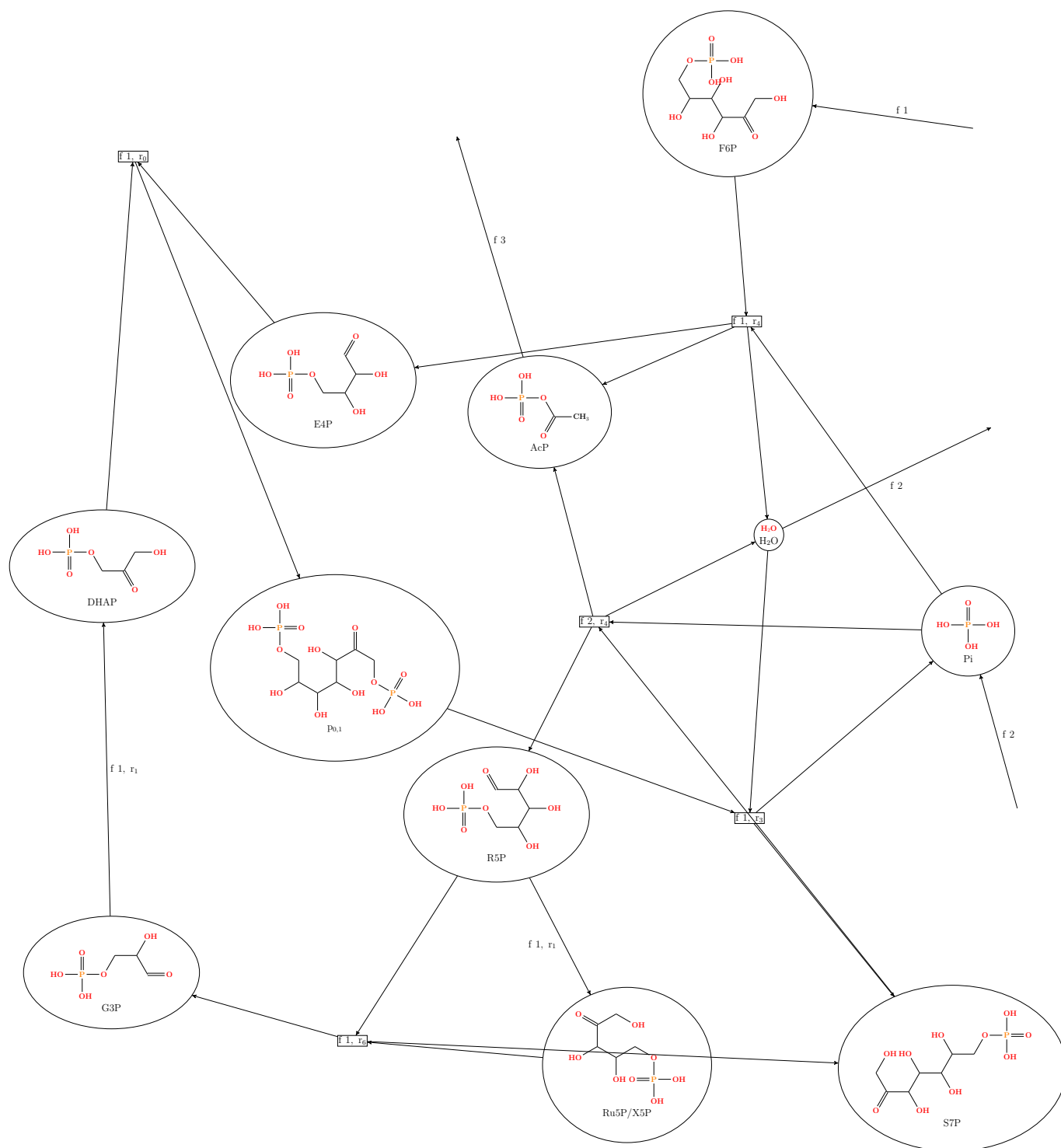
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

## Filtered Graph



File: out/304\_dg\_0\_11100\_f\_0\_8\_filt

$$|E| = 7 \quad |P| = 8$$

### 0.10.4 Solution 9

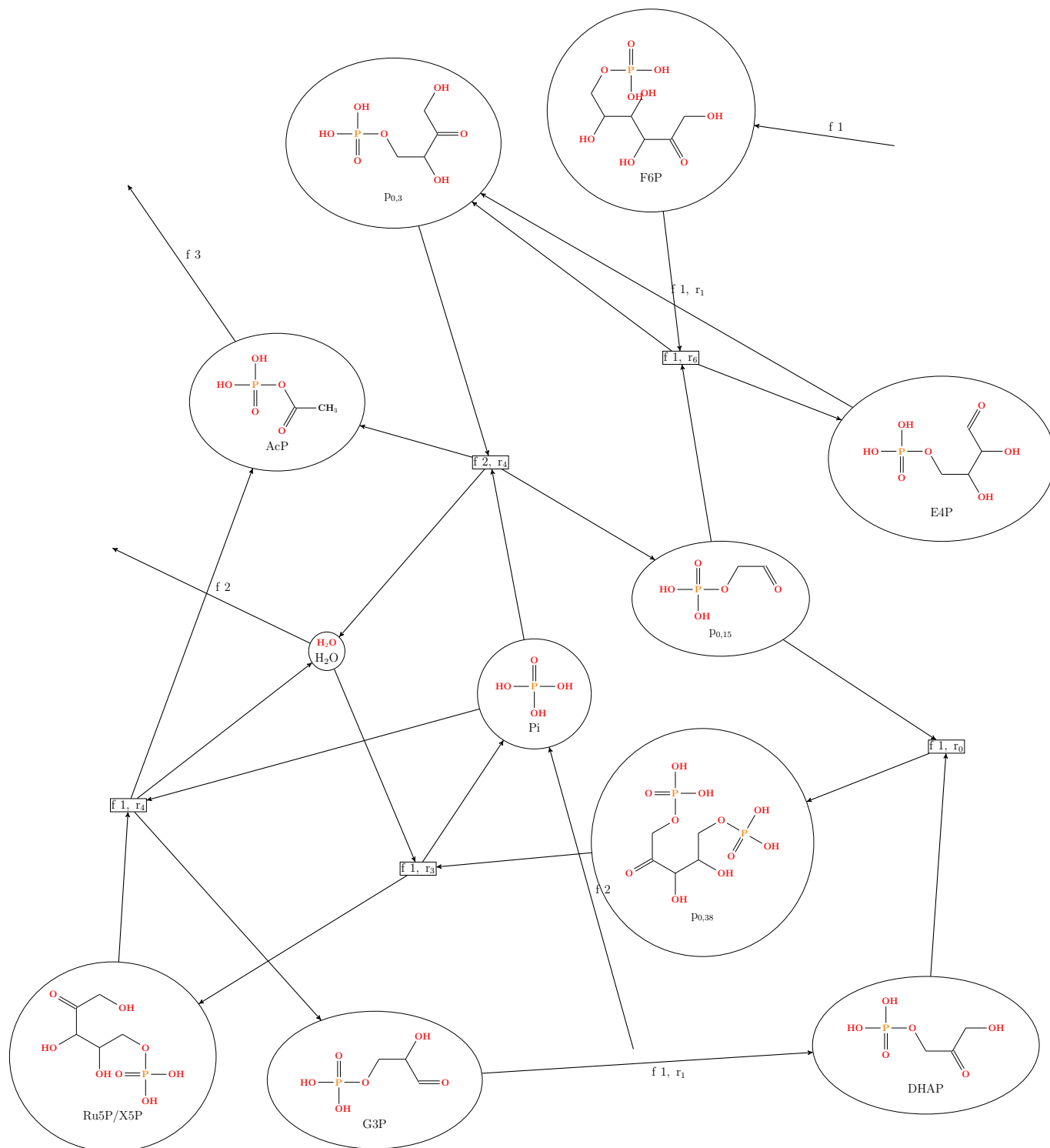
#### Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

## Filtered Graph



File: out/309\_dg\_0\_11100\_f\_0\_9\_filt

$$|E| = 7 \quad |P| = 8$$

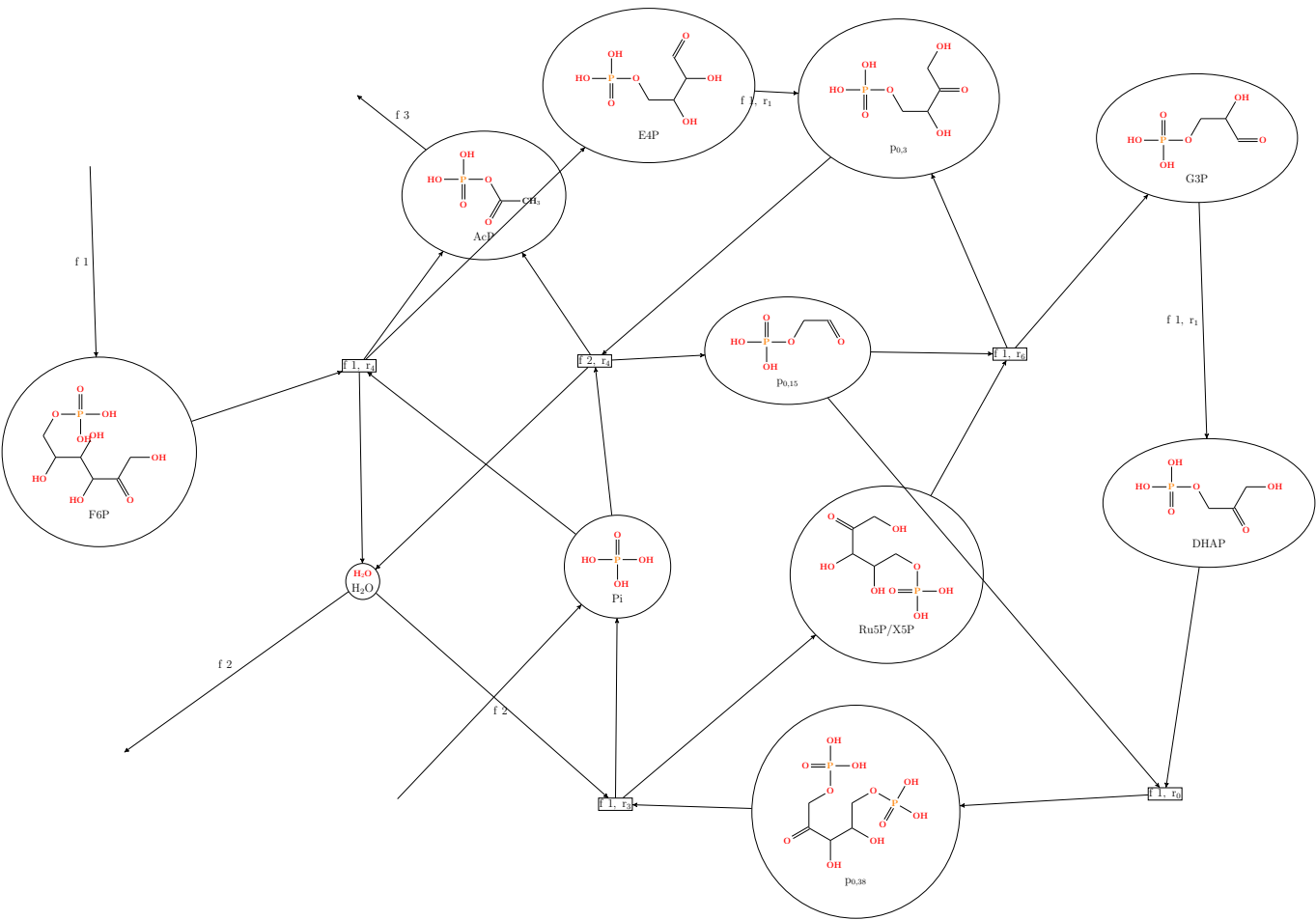
0.10.5 Solution 10

Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/314\_dg\_0\_11100\_f\_0\_10\_filt

$|E| = 7 \quad |P| = 8$

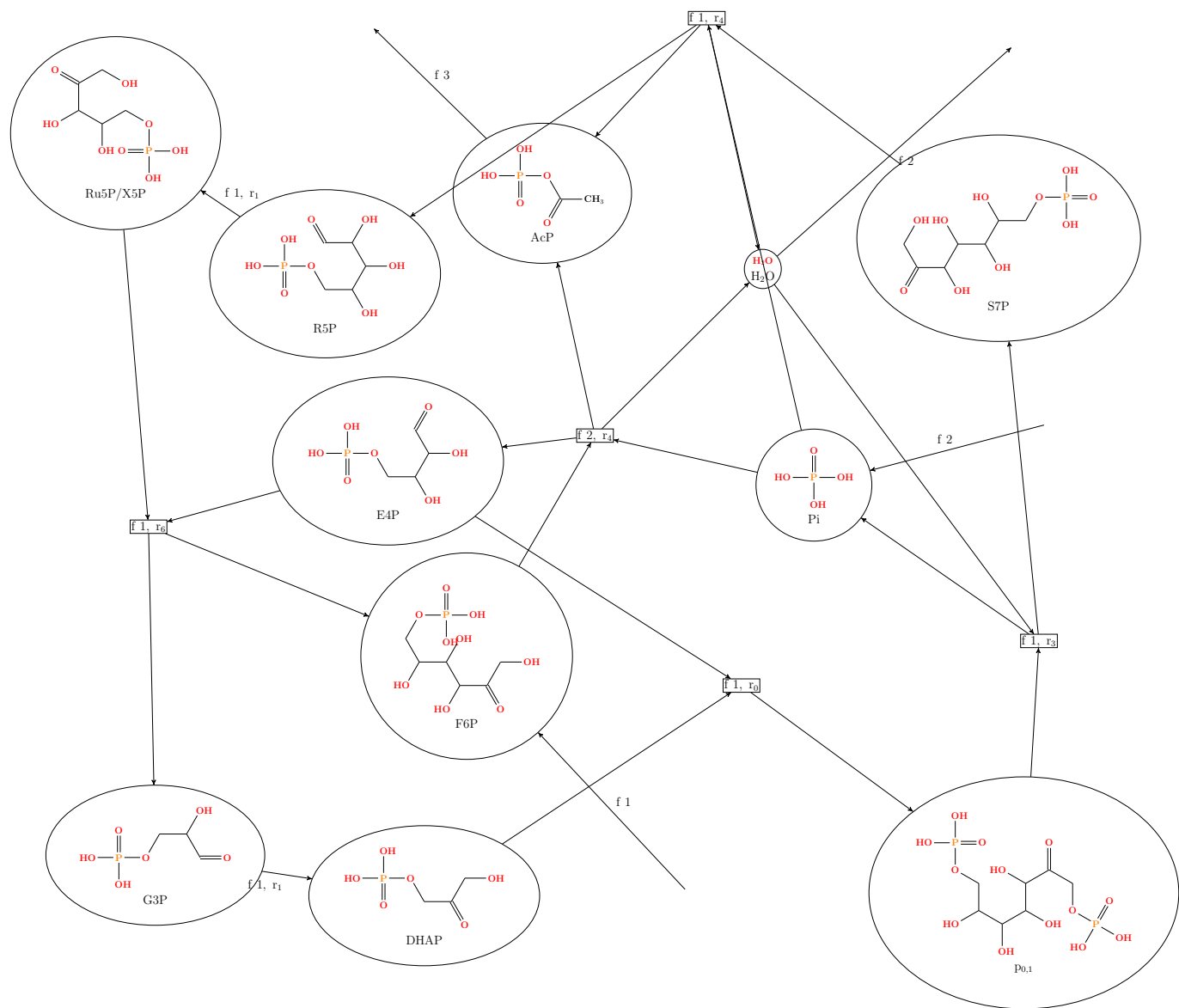
0.10.6 Solution 11

Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/319\_dg\_0\_11100\_f\_0\_11\_filt

$|E| = 7 \quad |P| = 8$

0.10.7 Solution 12

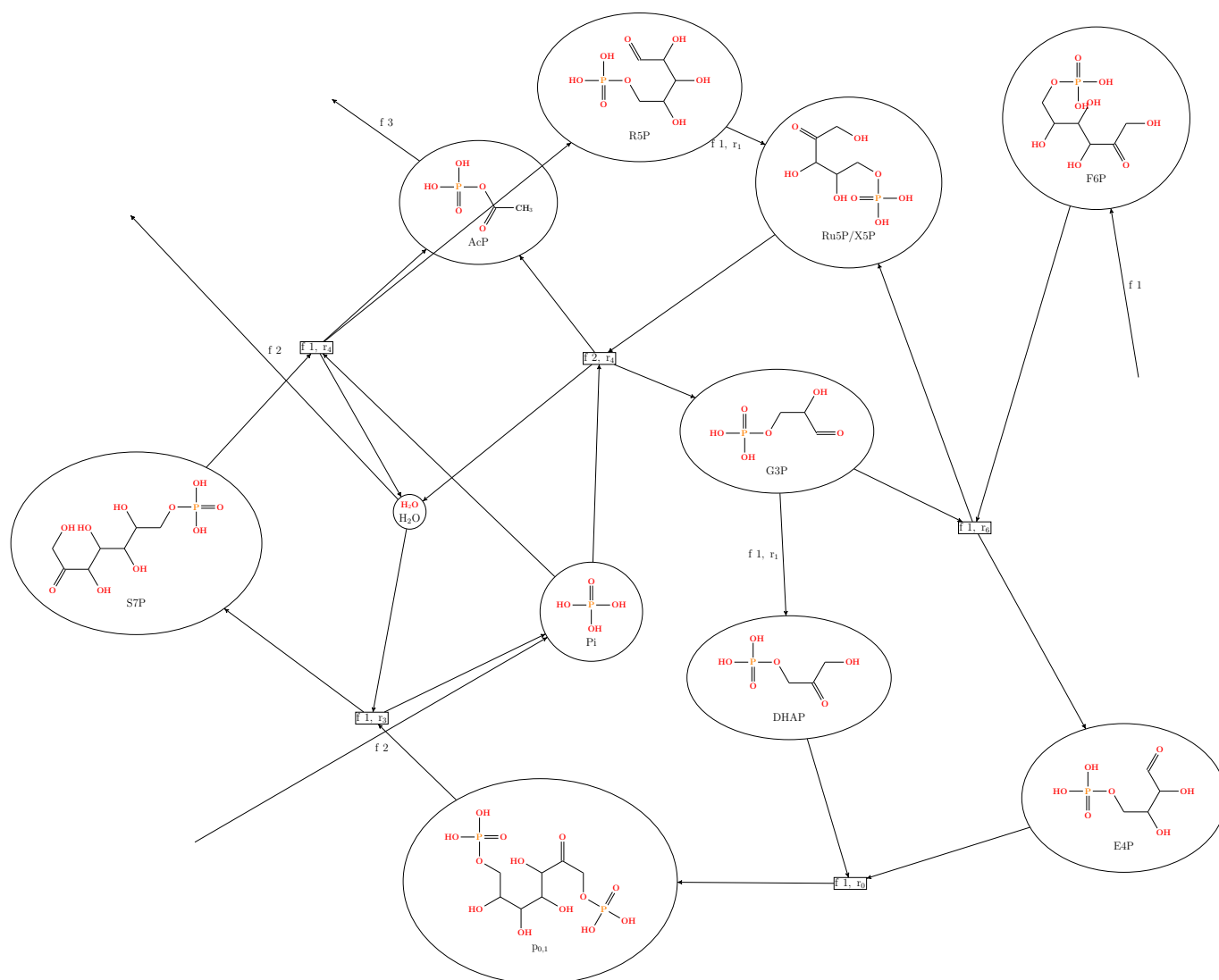
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

## Filtered Graph



File: out/324\_dg\_0\_11100\_f\_0\_12\_filt

$|E| = 7 \quad |P| = 8$

### 0.10.8 Solution 14

## Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	0	0
46	0	0
47	0	0
48	0	0
49	0	0
50	0	0
51	0	0
52	0	0
53	0	0
54	0	0
55	0	0
56	0	0
57	0	0
58	0	0
59	0	0
60	0	0
61	0	0
62	0	0
63	0	0
64	0	0
65	0	0
66	0	0
67	0	0
68	0	0
69	0	0
70	0	0
71	0	0
72	0	0
73	0	0
74	0	0
75	0	0
76	0	0
77	0	0
78	0	0
79	0	0
80	0	0
81	0	0
82	0	0
83	0	0
84	0	0
85	0	0
86	0	0
87	0	0
88	0	0
89	0	0
90	0	0
91	0	0
92	0	0
93	0	0
94	0	0
95	0	0
96	0	0
97	0	0
98	0	0
99	0	0
100	0	0

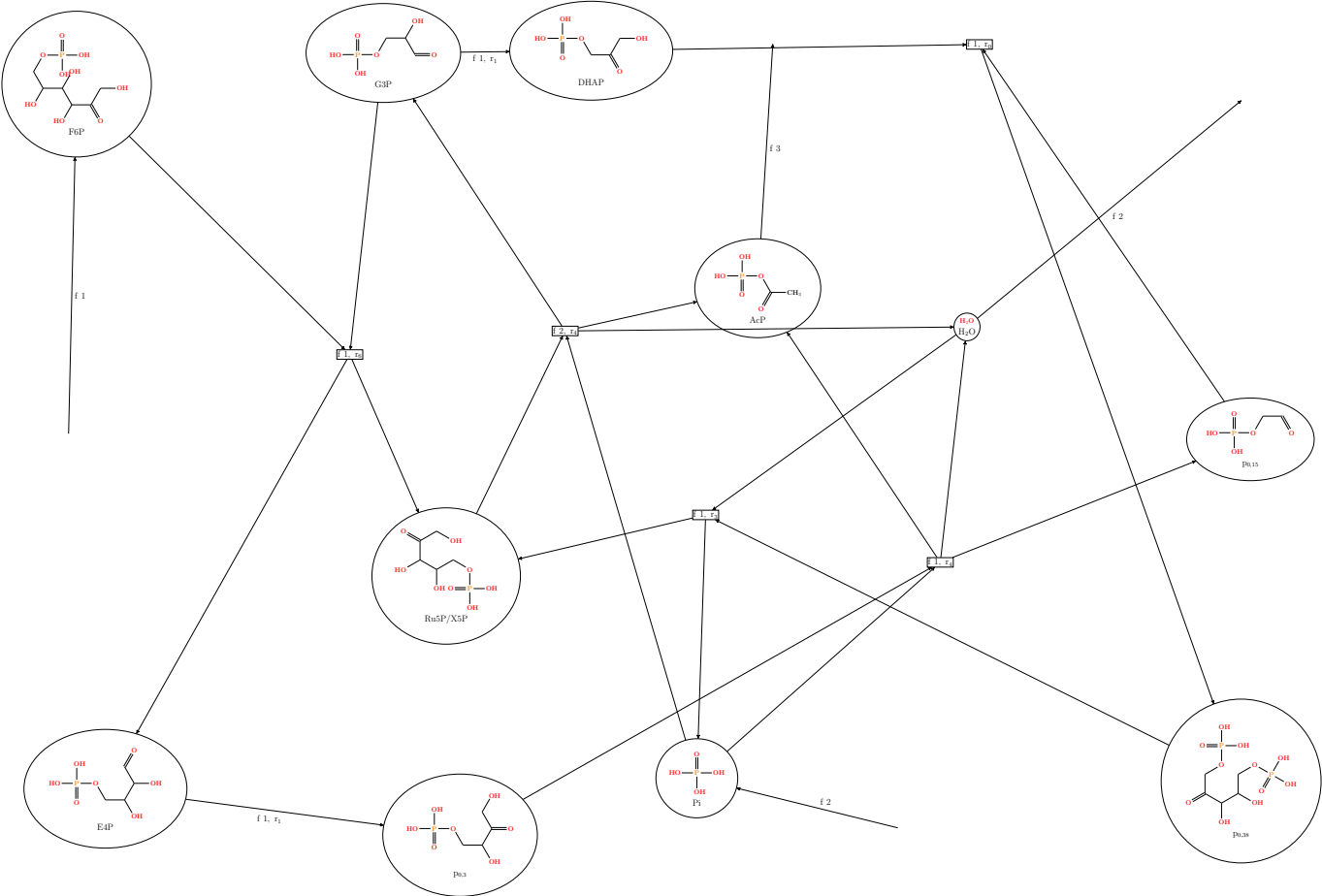
AcP 0 3

F6P	1	0
-----	---	---

H\_20                      0   2

Pi 2 0

Filtered Graph



File: out/329\_dg\_0\_11100\_f\_0\_14\_filt

$|E| = 7 \quad |P| = 8$

0.10.9 Solution 17

Overall Data

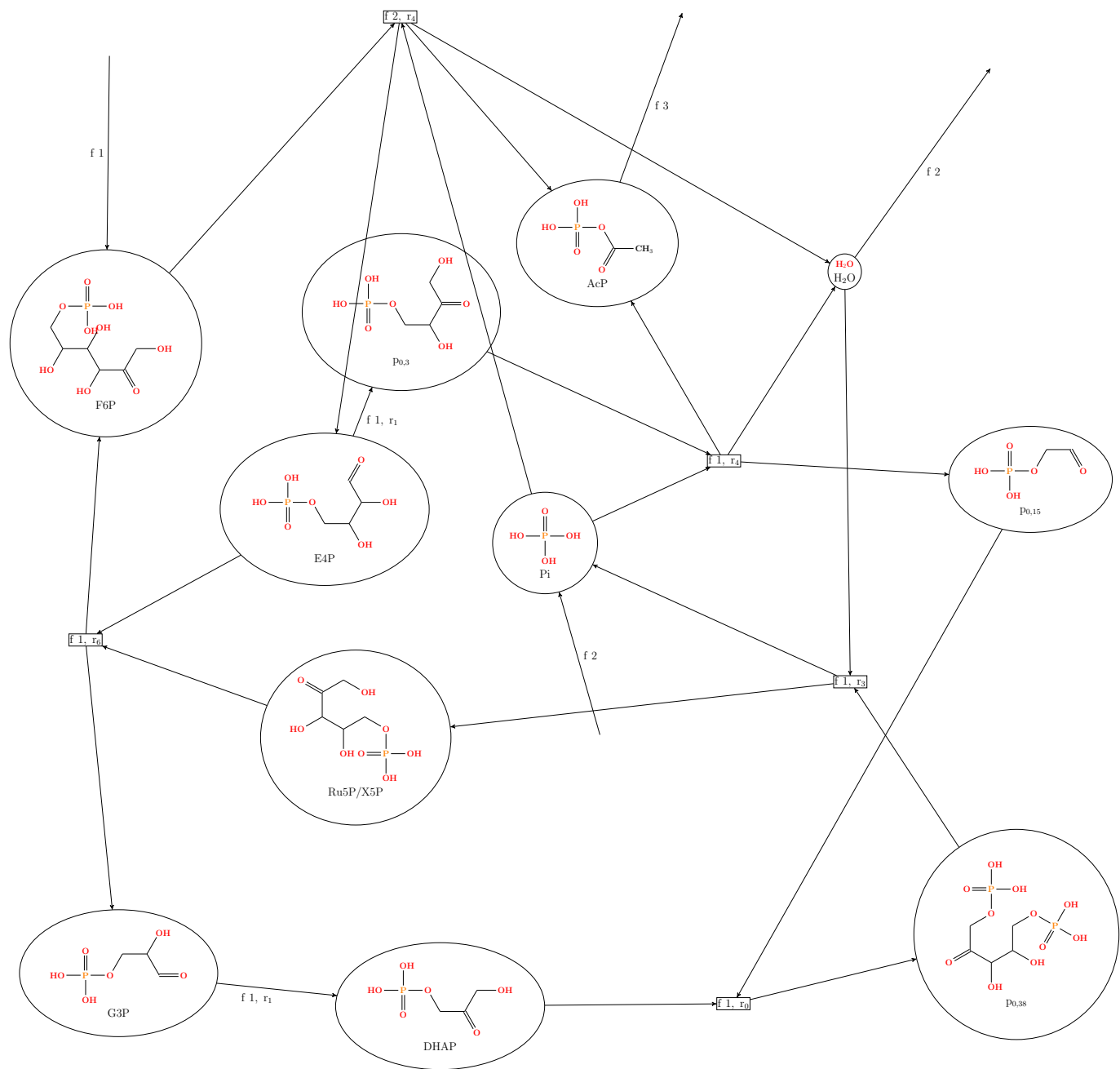
Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0



Filtered Graph



File: out/334\_dg\_0\_11100\_f\_0\_17\_filt

$|E| = 7 \quad |P| = 8$

0.10.10 Solution 21

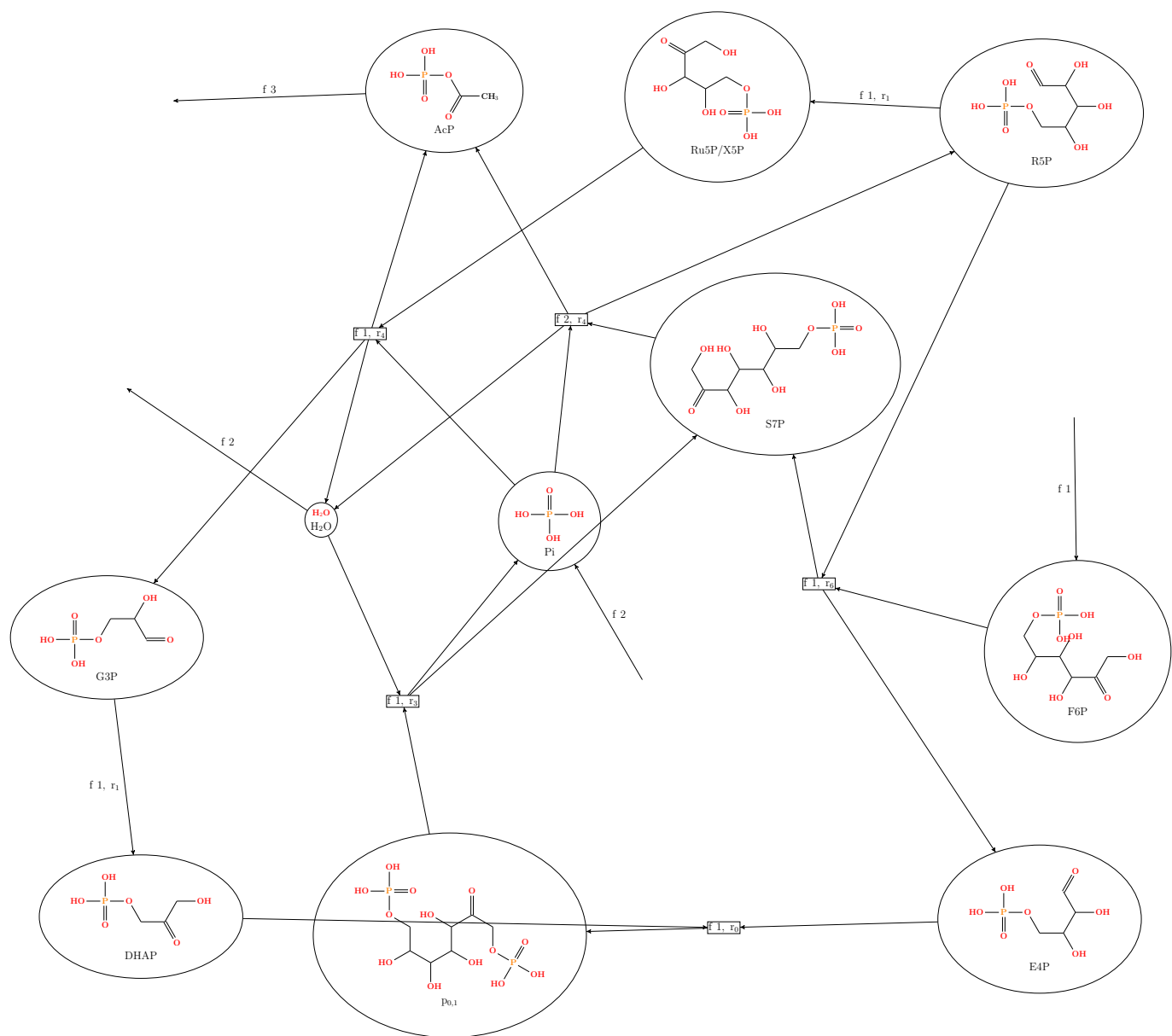
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_2O	0	2
Pi	2	0

Filtered Graph



File: out/339\_dg\_0\_11100\_f\_0\_21\_filt

$|E| = 7 \quad |P| = 8$

0.10.11 Solution 31

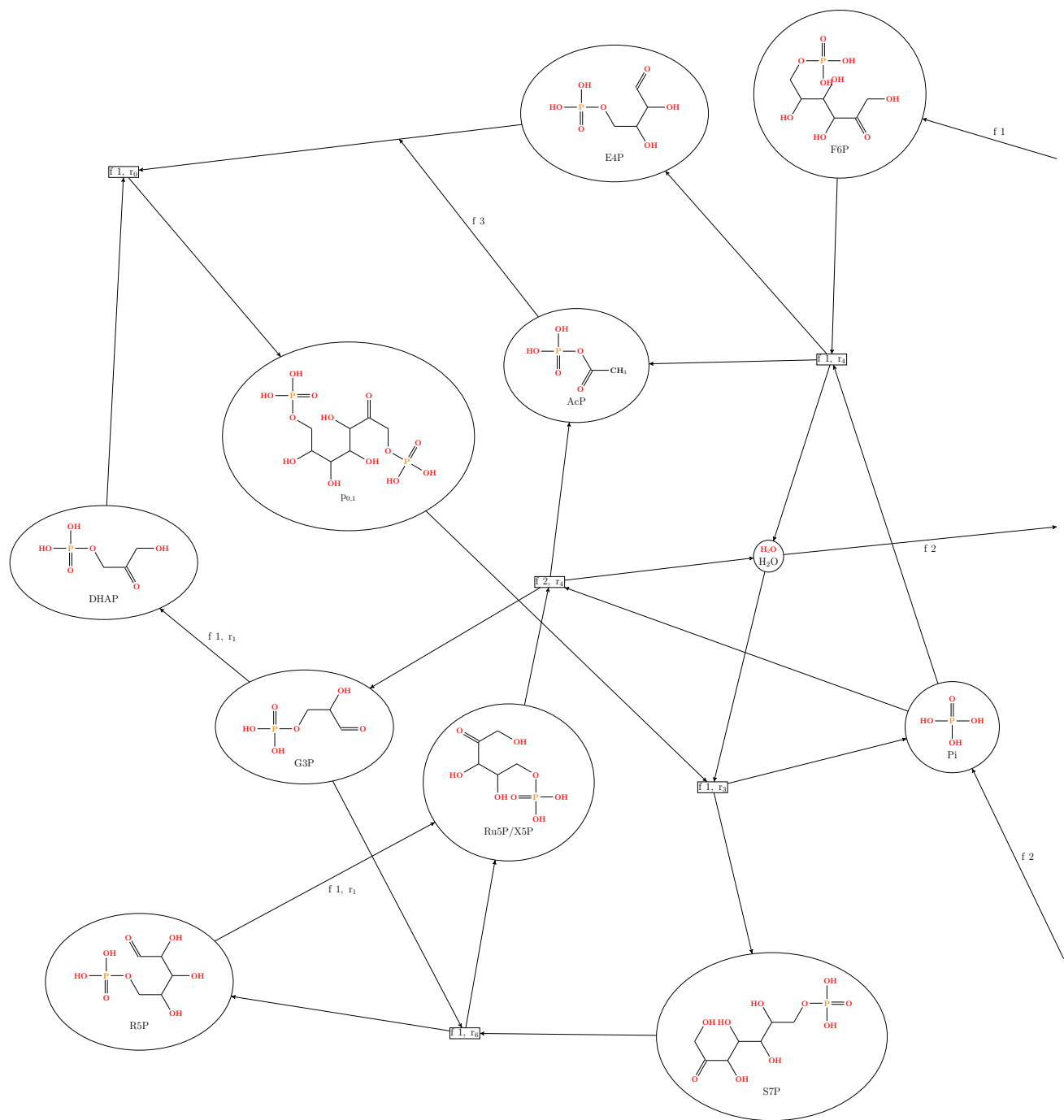
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/344\_dg\_0\_11100\_f\_0\_31\_filt

$|E| = 7 \quad |P| = 8$

0.10.12 Solution 32

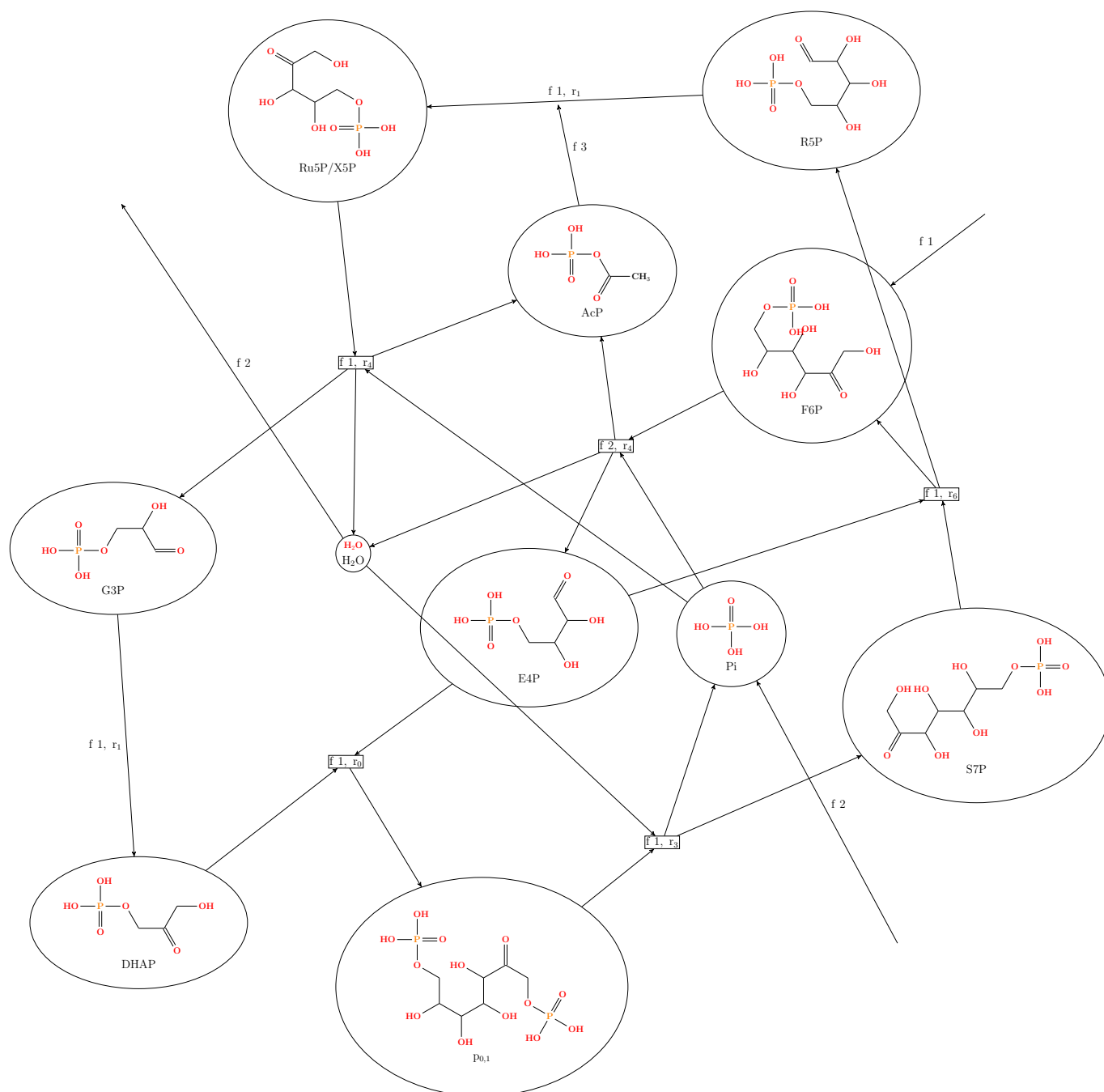
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

## Filtered Graph



File: out/349\_dg\_0\_11100\_f\_0\_32\_filt

$$|E| = 7 \quad |P| = 8$$

## 0.11 Enumerated Flows with 8 unique reactions

### 0.11.1 Solution 2

#### Overall Data

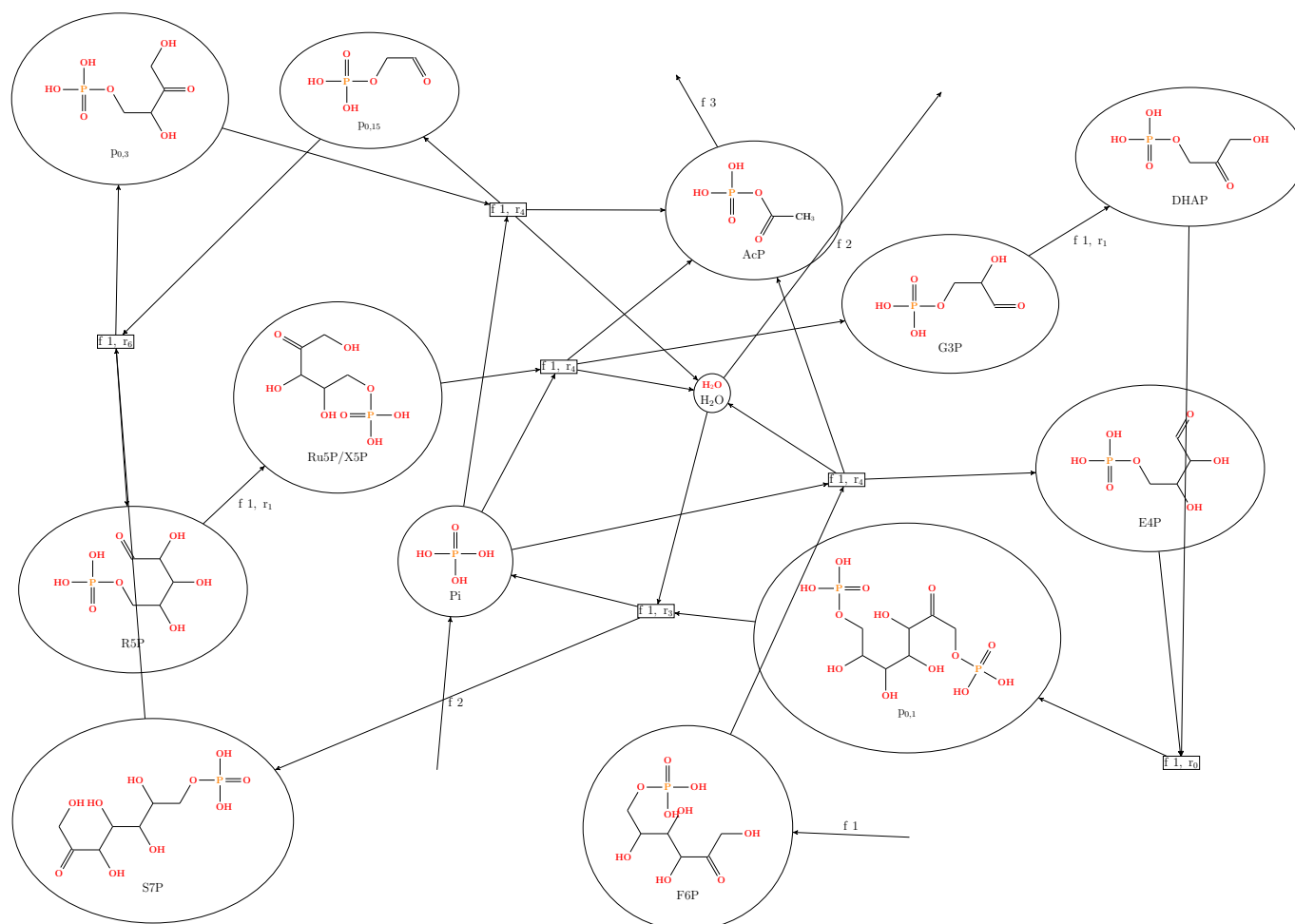
Objective value (integral): 8

Vertex/Graph In Out

AcP 0 3

F6P	1	0
H_20	0	2
Pi	2	0

## Filtered Graph



File: out/354\_dg\_0\_11100\_f\_0\_2\_filt

$$|E| = 8 \quad |P| = 8$$

## 0.11.2 Solution 3

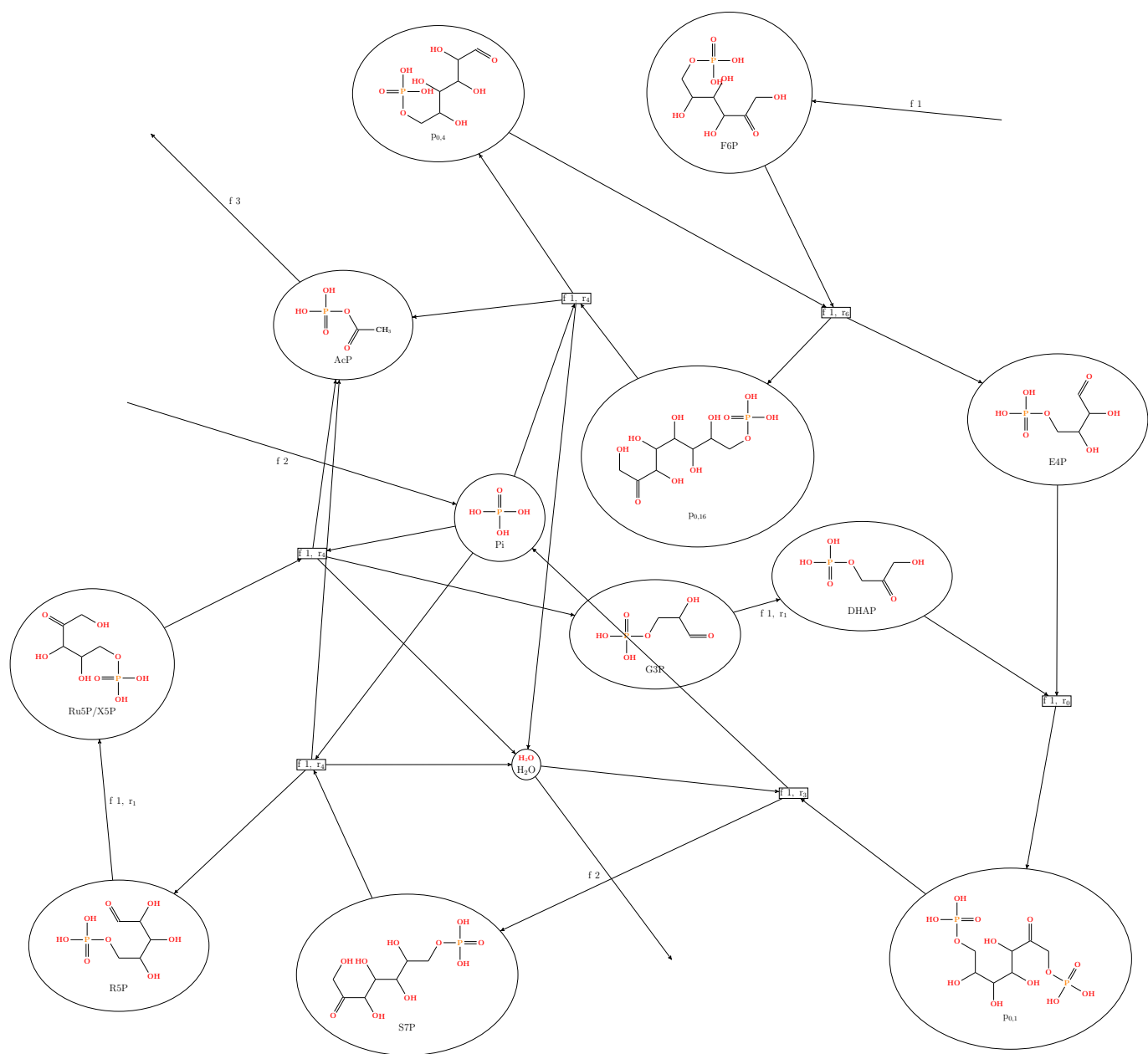
### Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/359\_dg\_0\_11100\_f\_0\_3\_filt

$|E| = 8 \quad |P| = 8$

0.11.3 Solution 4

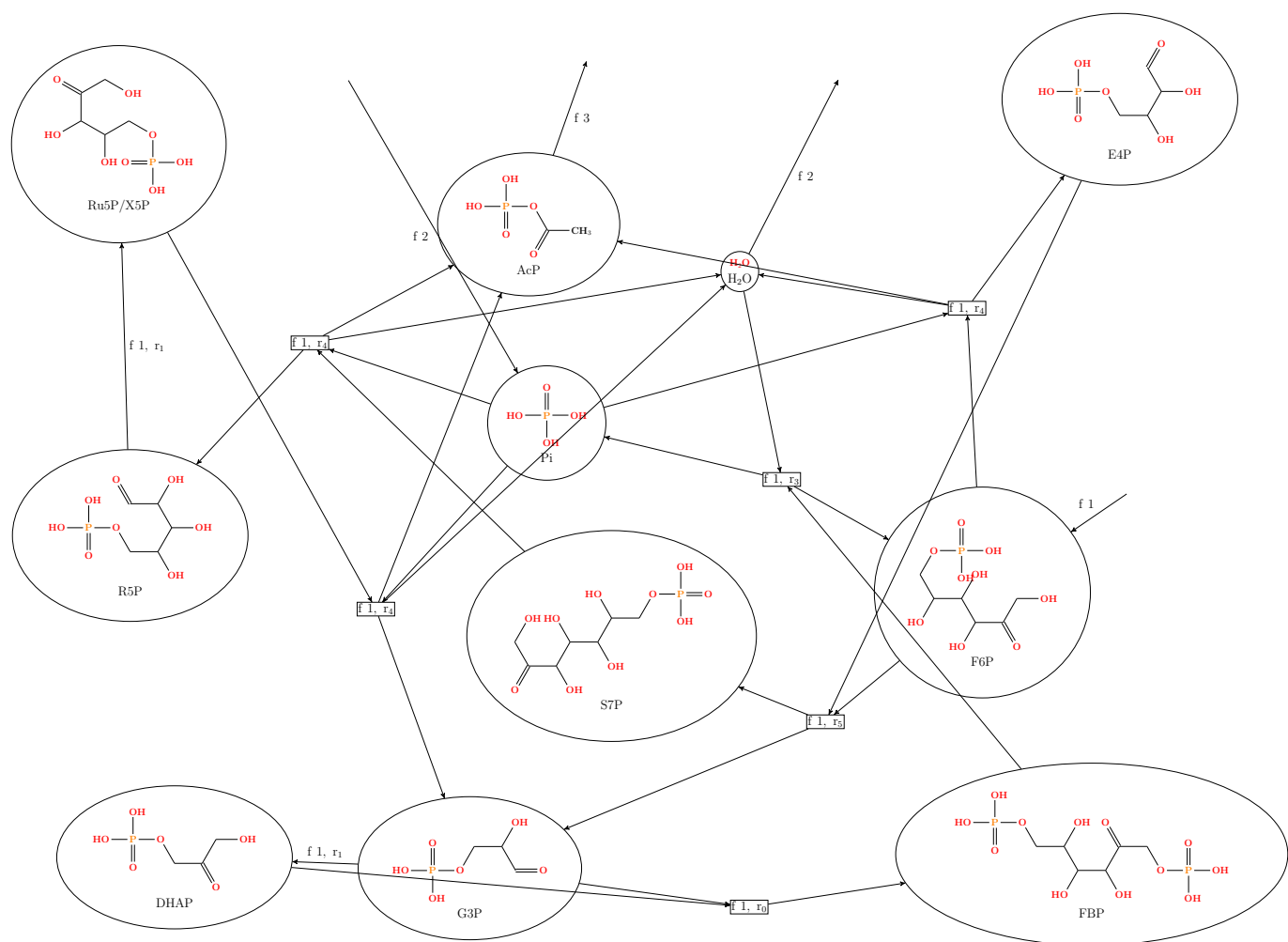
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/364\_dg\_0\_11100\_f\_0\_4\_filt

$|E| = 8 \quad |P| = 8$

0.11.4 Solution 6

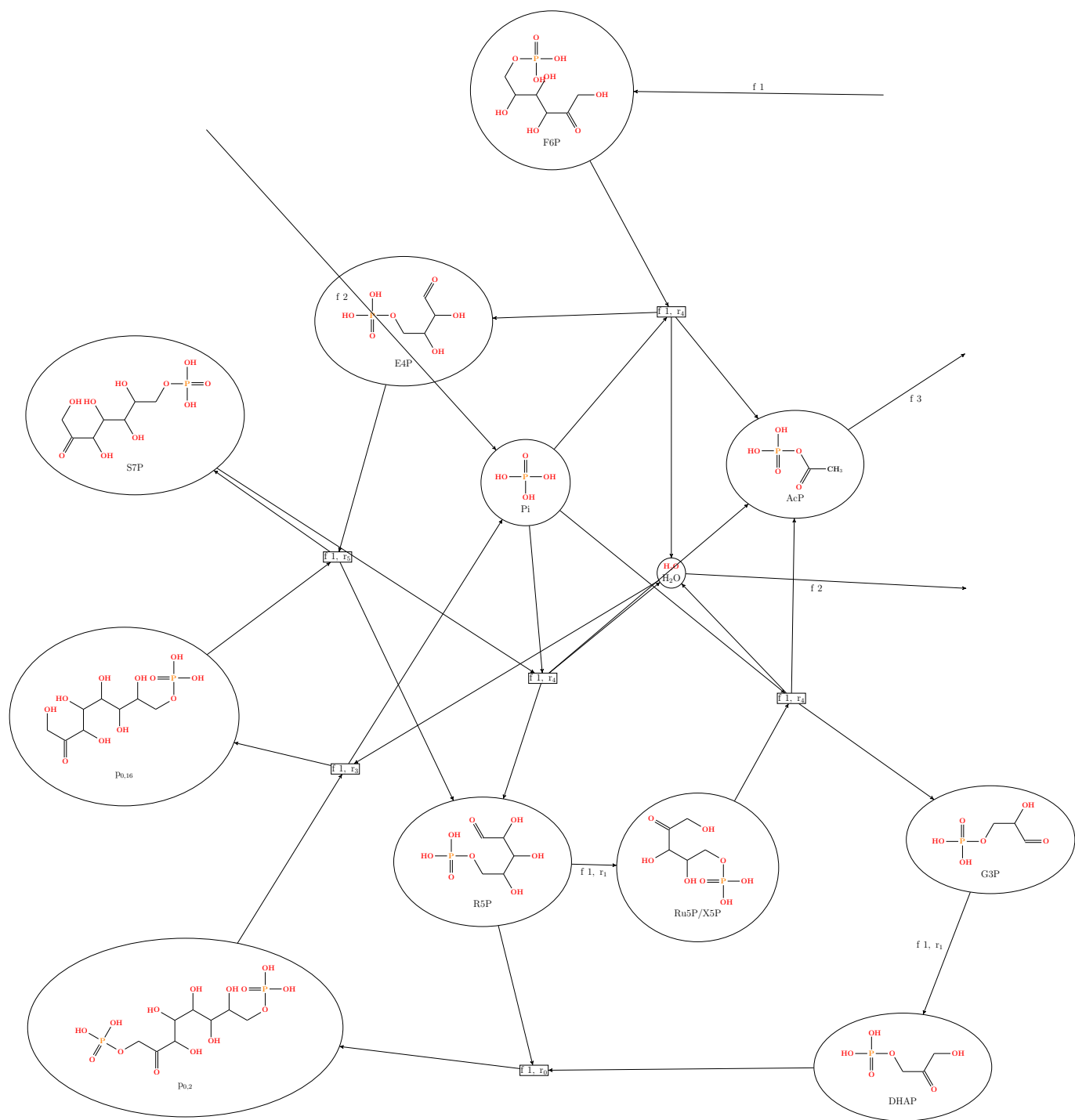
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
P <sub>i</sub>	2	0

Filtered Graph



File: out/369\_dg\_0\_11100\_f\_0\_6\_filt

$|E| = 8 \quad |P| = 8$

0.11.5 Solution 13

Overall Data

Objective value (integral): 8

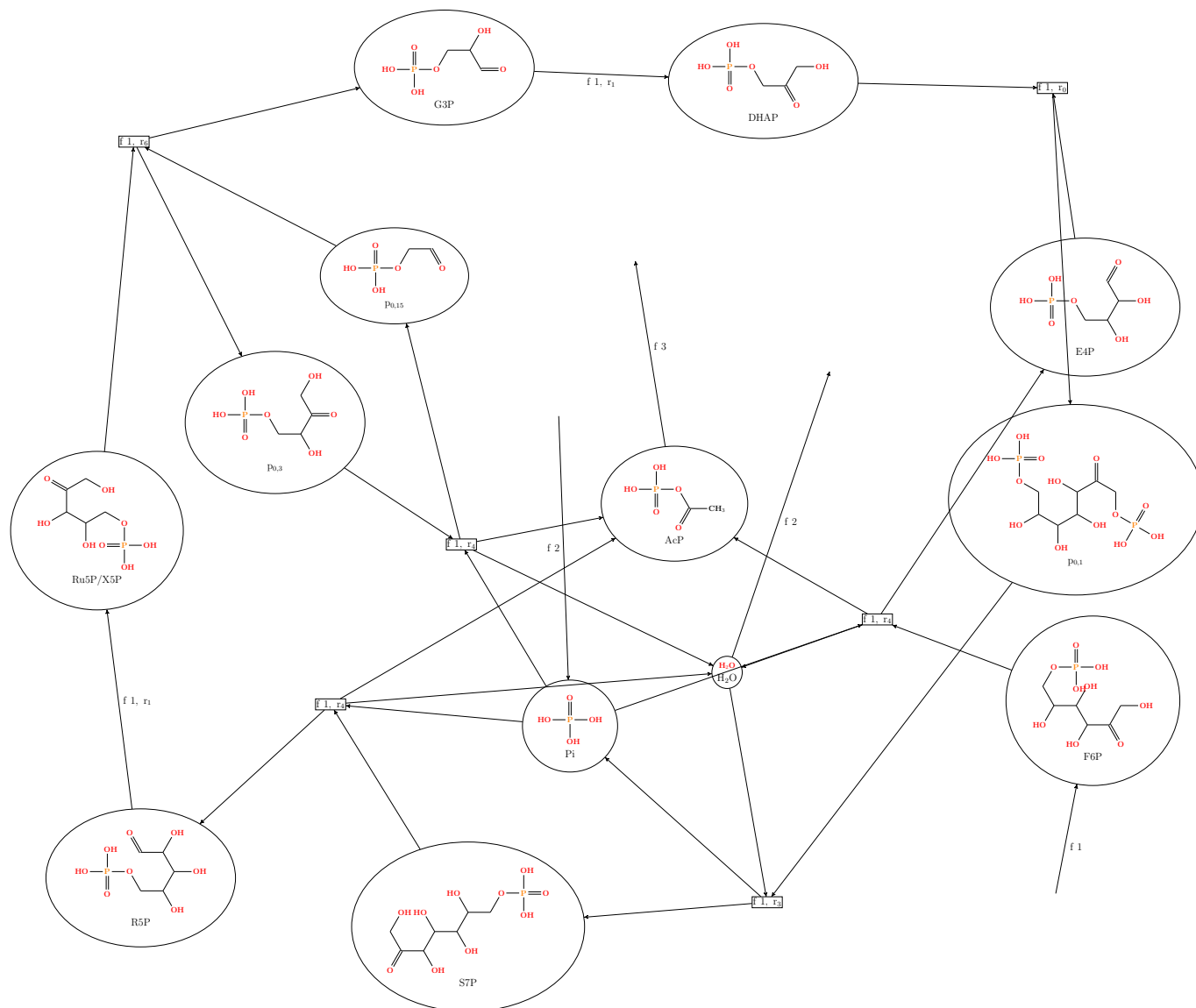
Vertex/Graph In Out

AcP	0	3
F6P	1	0



H_20	0	2
Pi	2	0

## Filtered Graph



File: out/374\_dg\_0\_11100\_f\_0\_13\_filt

$|E| = 8 \quad |P| = 8$

### 0.11.6 Solution 15

## Overall Data

Objective value (integral): 8

Vertex/Graph In Out

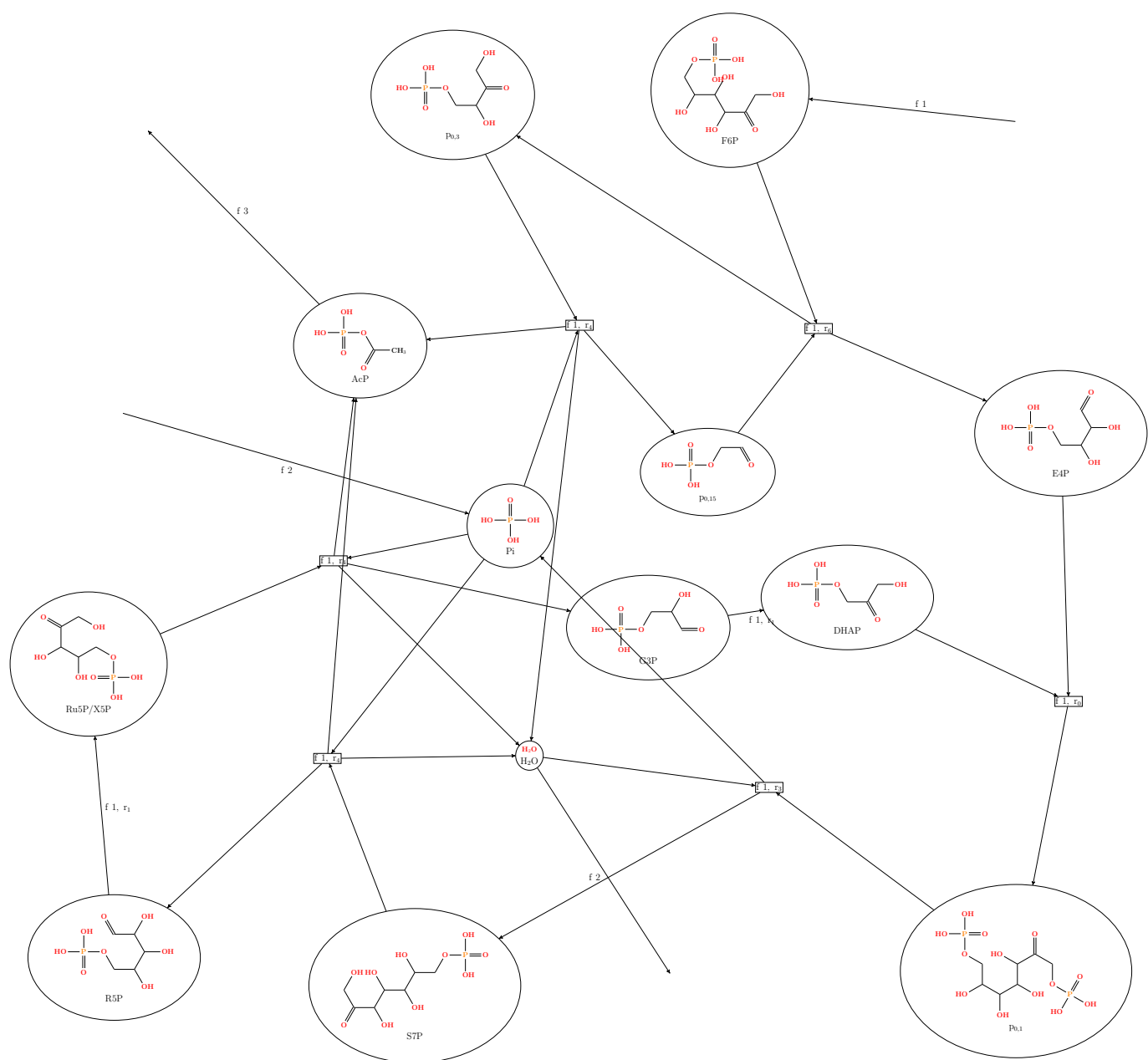
AcP 0 3

F6P	1	0
-----	---	---

H 20                      0 2

Pi 2 0

Filtered Graph



File: out/379\_dg\_0\_11100\_f\_0\_15\_filt

$|E| = 8 \quad |P| = 8$

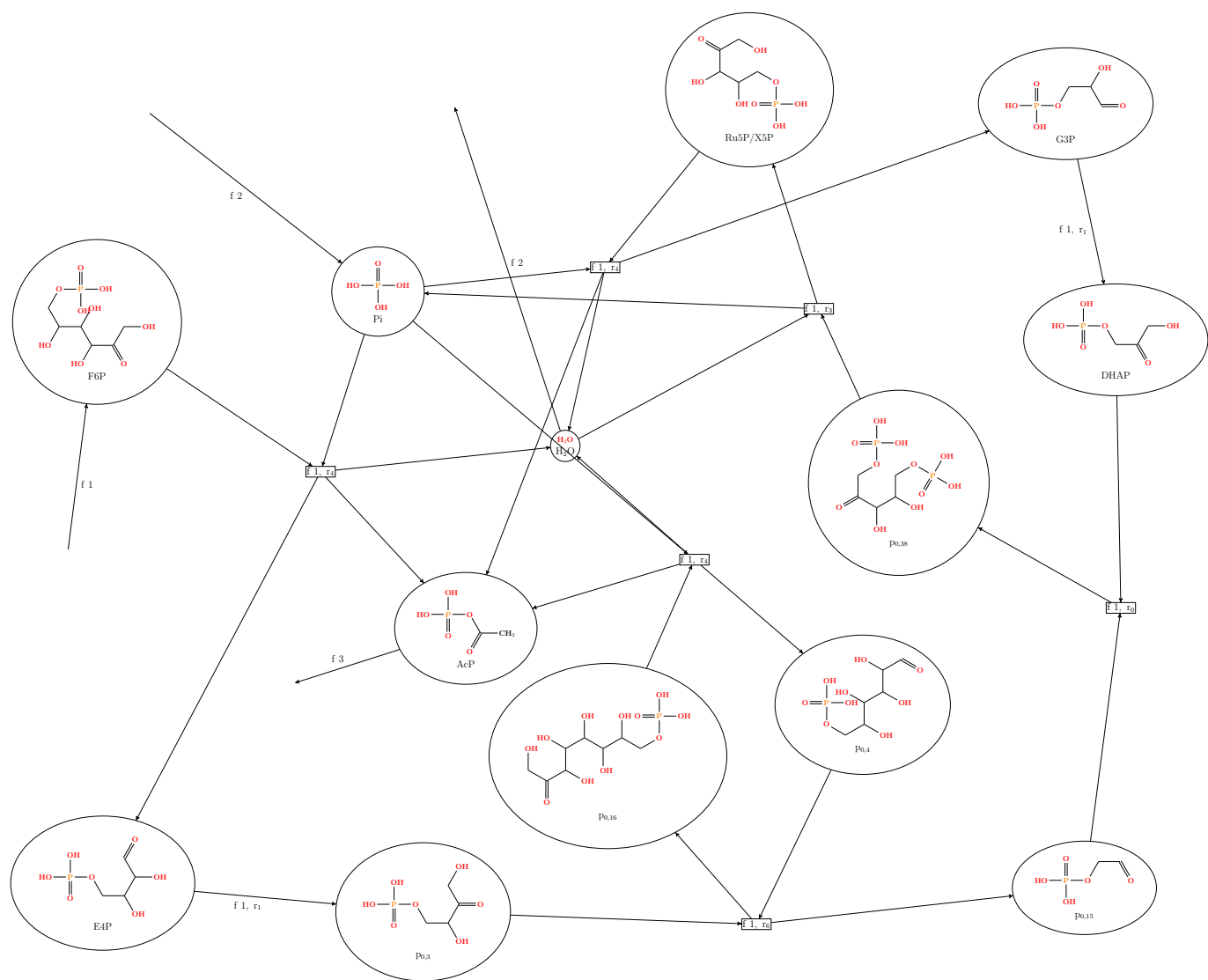
0.11.7 Solution 16

Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

Filtered Graph



File: out/384\_dg\_0\_11100\_f\_0\_16\_filt

$|E| = 8 \quad |P| = 8$

0.11.8 Solution 18

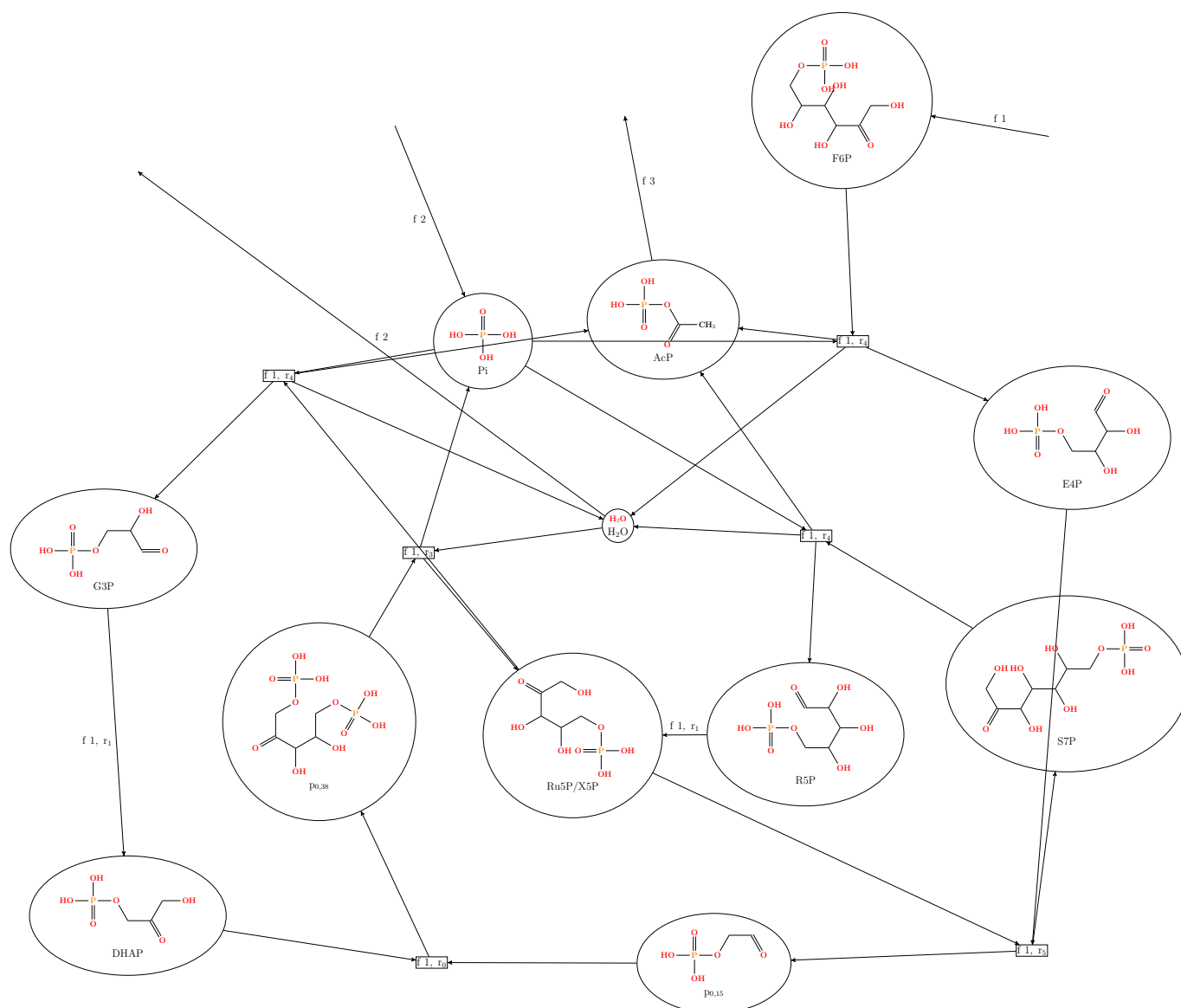
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

## Filtered Graph



File: out/389\_dg\_0\_11100\_f\_0\_18\_filt

$|E| = 8 \quad |P| = 8$

### 0.11.9 Solution 19

## Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	0	0
46	0	0
47	0	0
48	0	0
49	0	0
50	0	0
51	0	0
52	0	0
53	0	0
54	0	0
55	0	0
56	0	0
57	0	0
58	0	0
59	0	0
60	0	0
61	0	0
62	0	0
63	0	0
64	0	0
65	0	0
66	0	0
67	0	0
68	0	0
69	0	0
70	0	0
71	0	0
72	0	0
73	0	0
74	0	0
75	0	0
76	0	0
77	0	0
78	0	0
79	0	0
80	0	0
81	0	0
82	0	0
83	0	0
84	0	0
85	0	0
86	0	0
87	0	0
88	0	0
89	0	0
90	0	0
91	0	0
92	0	0
93	0	0
94	0	0
95	0	0
96	0	0
97	0	0
98	0	0
99	0	0
100	0	0
101	0	0
102	0	0
103	0	0
104	0	0
105	0	0
106	0	0
107	0	0
108	0	0
109	0	0
110	0	0
111	0	0
112	0	0
113	0	0
114	0	0
115	0	0
116	0	0
117	0	0
118	0	0
119	0	0
120	0	0
121	0	0
122	0	0
123	0	0
124	0	0
125	0	0
126	0	0
127	0	0
128	0	0
129	0	0
130	0	0
131	0	0
132	0	0
133	0	0
134	0	0
135	0	0
136	0	0
137	0	0
138	0	0
139	0	

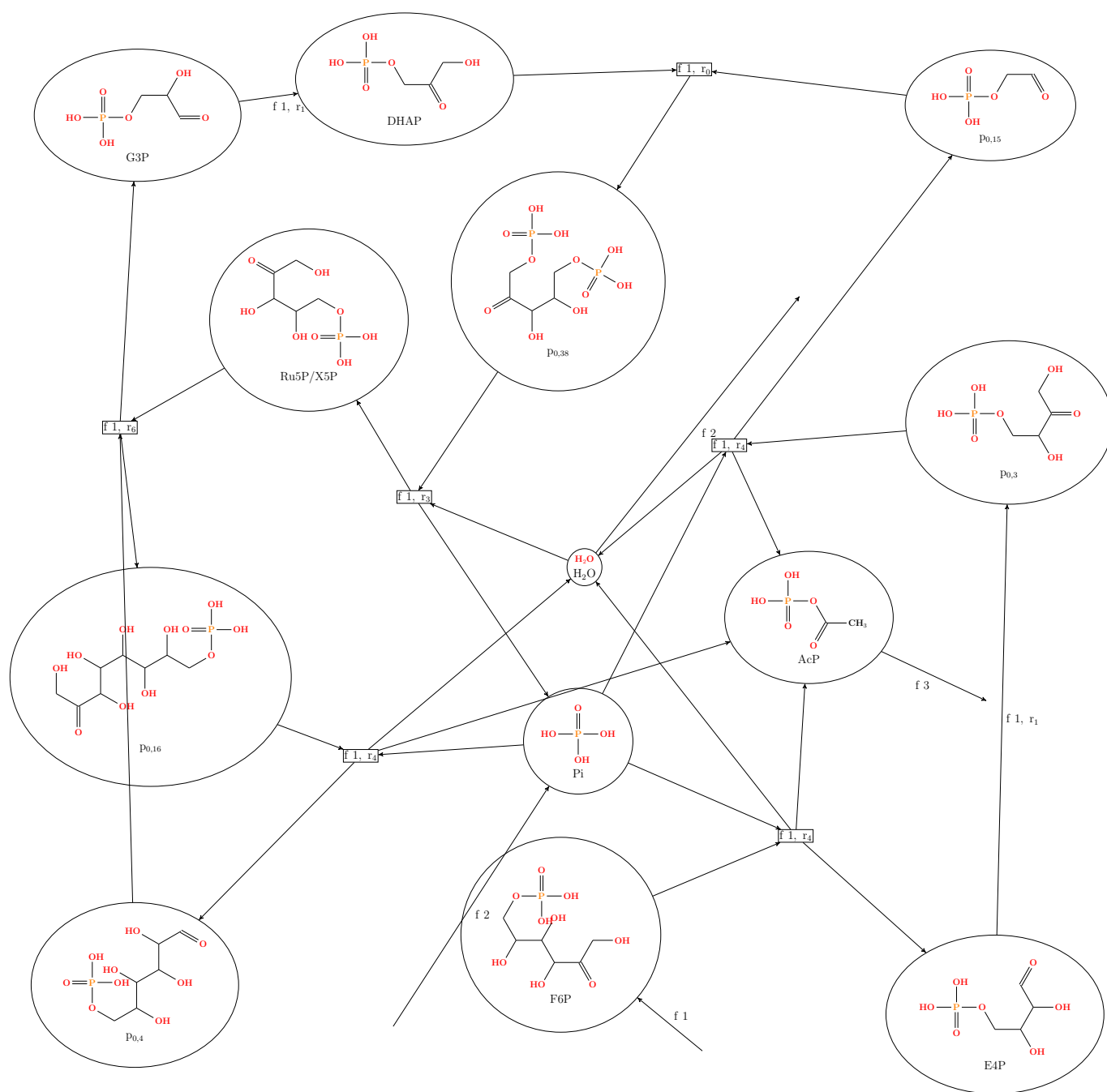
AcP 0 3

F6P	1	0
-----	---	---

H 20                      0 2

$$\bar{P}_i \quad 2 \quad 0$$

## Filtered Graph



File: out/394\_dg\_0\_11100\_f\_0\_19\_filt

$|E| = 8 \quad |P| = 8$

### 0.11.10 Solution 20

## Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	0	0
46	0	0
47	0	0
48	0	0
49	0	0
50	0	0
51	0	0
52	0	0
53	0	0
54	0	0
55	0	0
56	0	0
57	0	0
58	0	0
59	0	0
60	0	0
61	0	0
62	0	0
63	0	0
64	0	0
65	0	0
66	0	0
67	0	0
68	0	0
69	0	0
70	0	0
71	0	0
72	0	0
73	0	0
74	0	0
75	0	0
76	0	0
77	0	0
78	0	0
79	0	0
80	0	0
81	0	0
82	0	0
83	0	0
84	0	0
85	0	0
86	0	0
87	0	0
88	0	0
89	0	0
90	0	0
91	0	0
92	0	0
93	0	0
94	0	0
95	0	0
96	0	0
97	0	0
98	0	0
99	0	0
100	0	0
101	0	0
102	0	0
103	0	0
104	0	0
105	0	0
106	0	0
107	0	0
108	0	0
109	0	0
110	0	0
111	0	0
112	0	0
113	0	0
114	0	0
115	0	0
116	0	0
117	0	0
118	0	0
119	0	0
120	0	0
121	0	0
122	0	0
123	0	0
124	0	0
125	0	0
126	0	0
127	0	0
128	0	0
129	0	0
130	0	0
131	0	0
132	0	0
133	0	0
134	0	0
135	0	0
136	0	0
137	0	0
138	0	0
139	0	

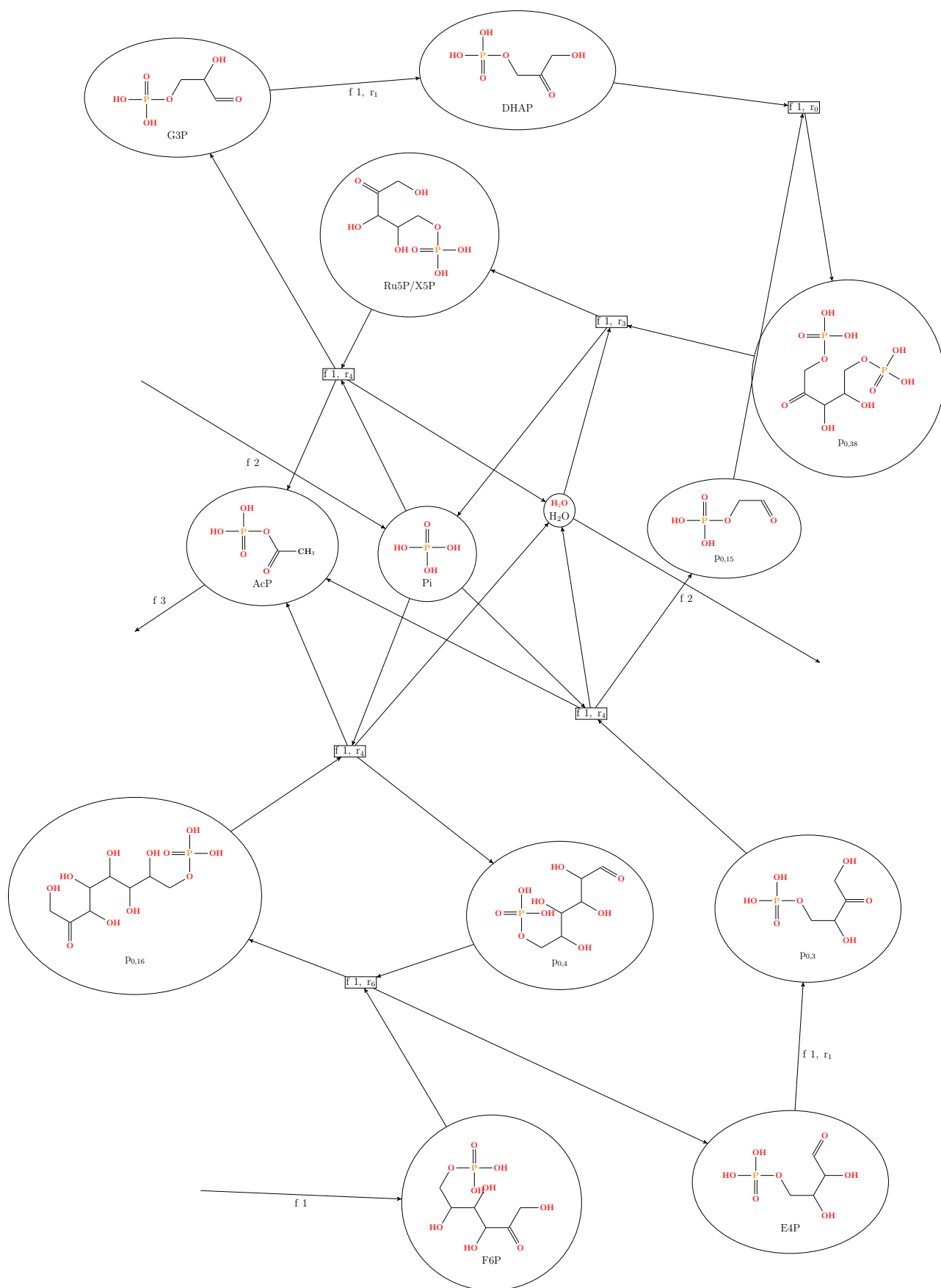
AcP 0 3

F6P	1	0
-----	---	---

H\_20                      0   2

$$\bar{P}i \quad 2 \quad 0$$

## Filtered Graph



File: out/399\_dg\_0\_11100\_f\_0\_20\_filt

$$|E| = 8 \quad |P| = 8$$

### 0.11.11 Solution 22

## Overall Data

Objective value (integral): 8

Vertex/Graph In Out

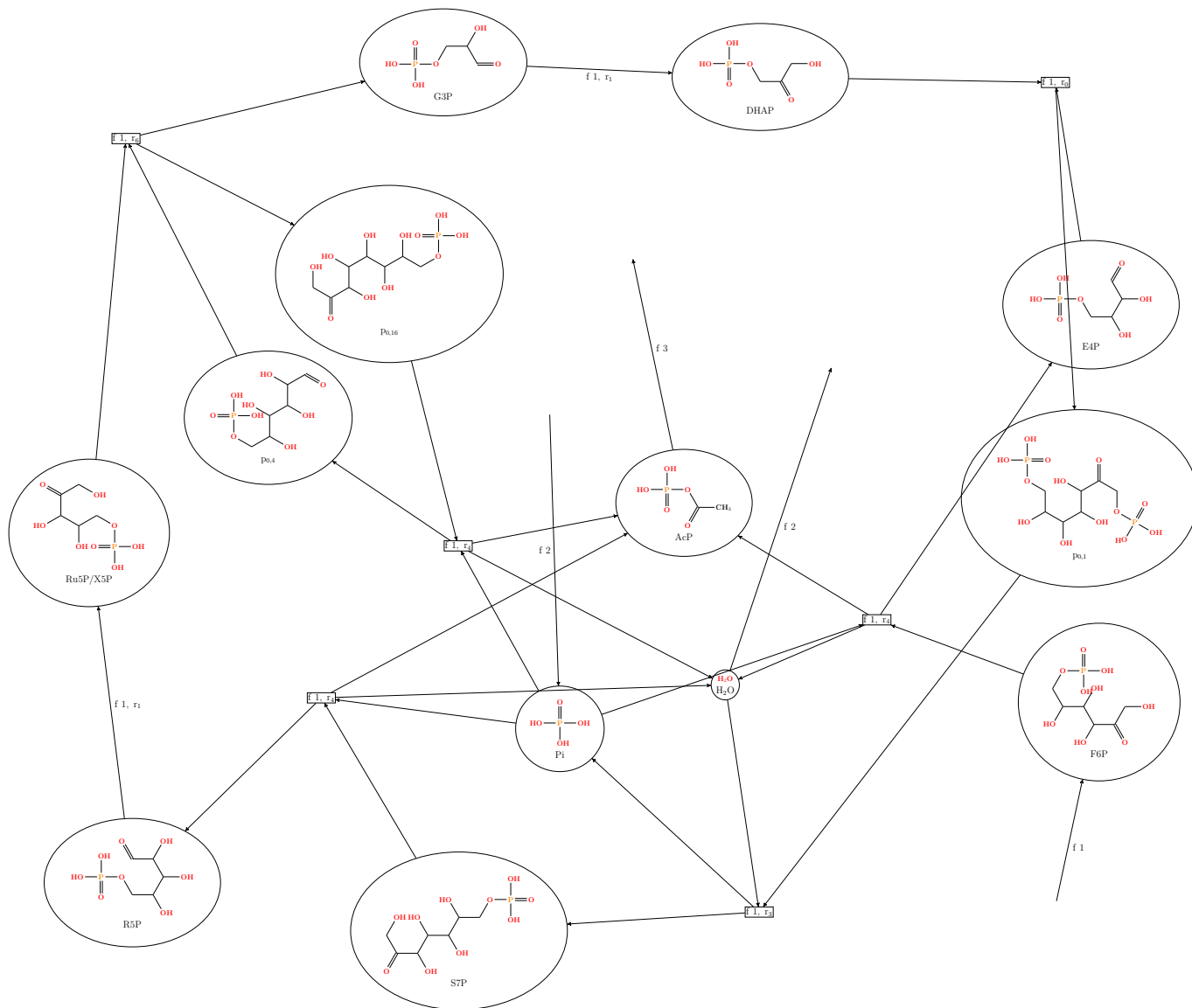
AcP                      0    3

F6P	1	0
-----	---	---

H 20 0 2

Pi 2 0

## Filtered Graph



File: out/404\_dg\_0\_11100\_f\_0\_22\_filt

$$|\mathbf{E}| = 8 \quad |\mathbf{P}| = 8$$

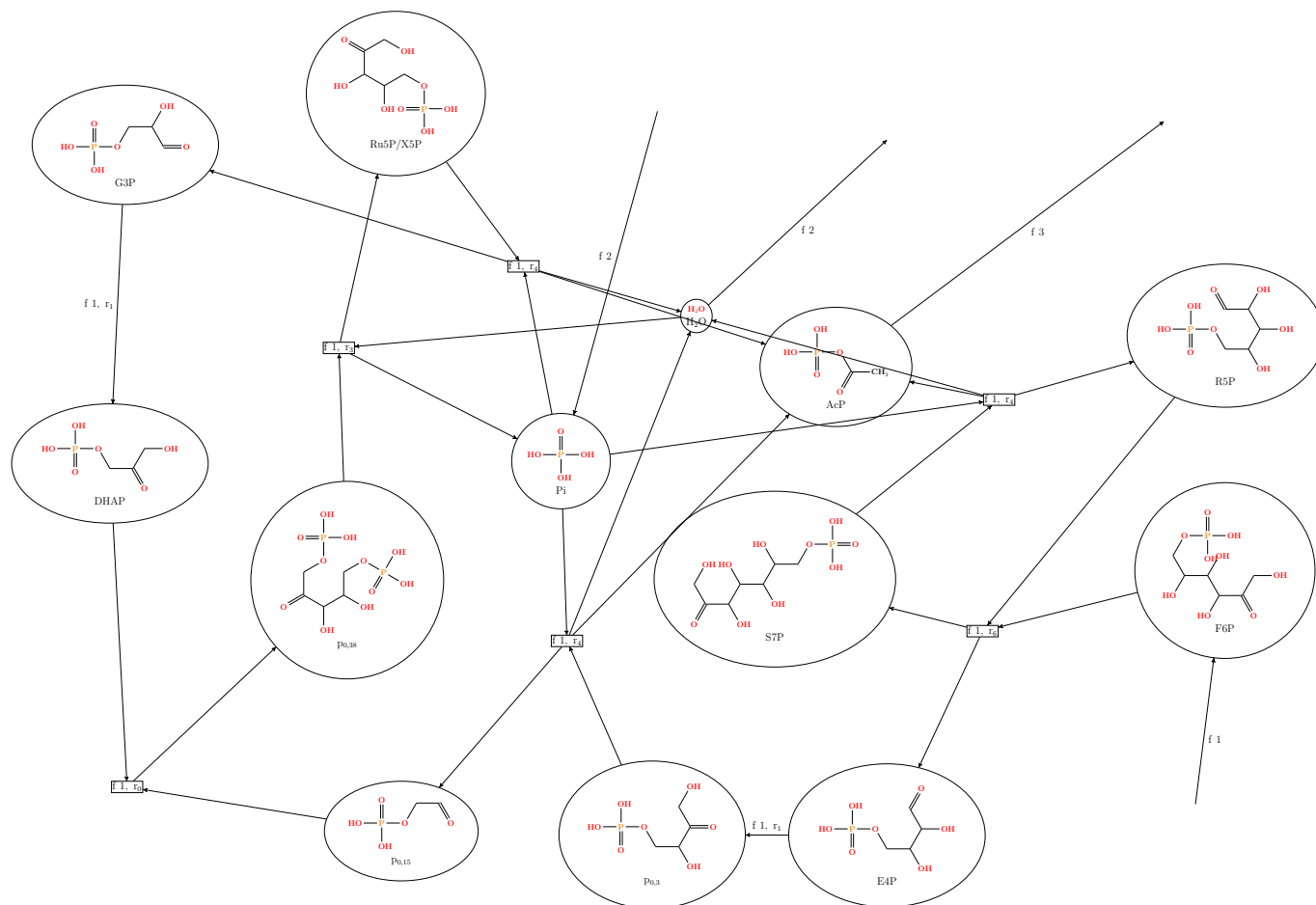
### 0.11.12 Solution 23

## Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

## Filtered Graph



File: out/409\_dg\_0\_11100\_f\_0\_23\_filt

$$|E| = 8 \quad |P| = 8$$

## 0.11.13 Solution 24

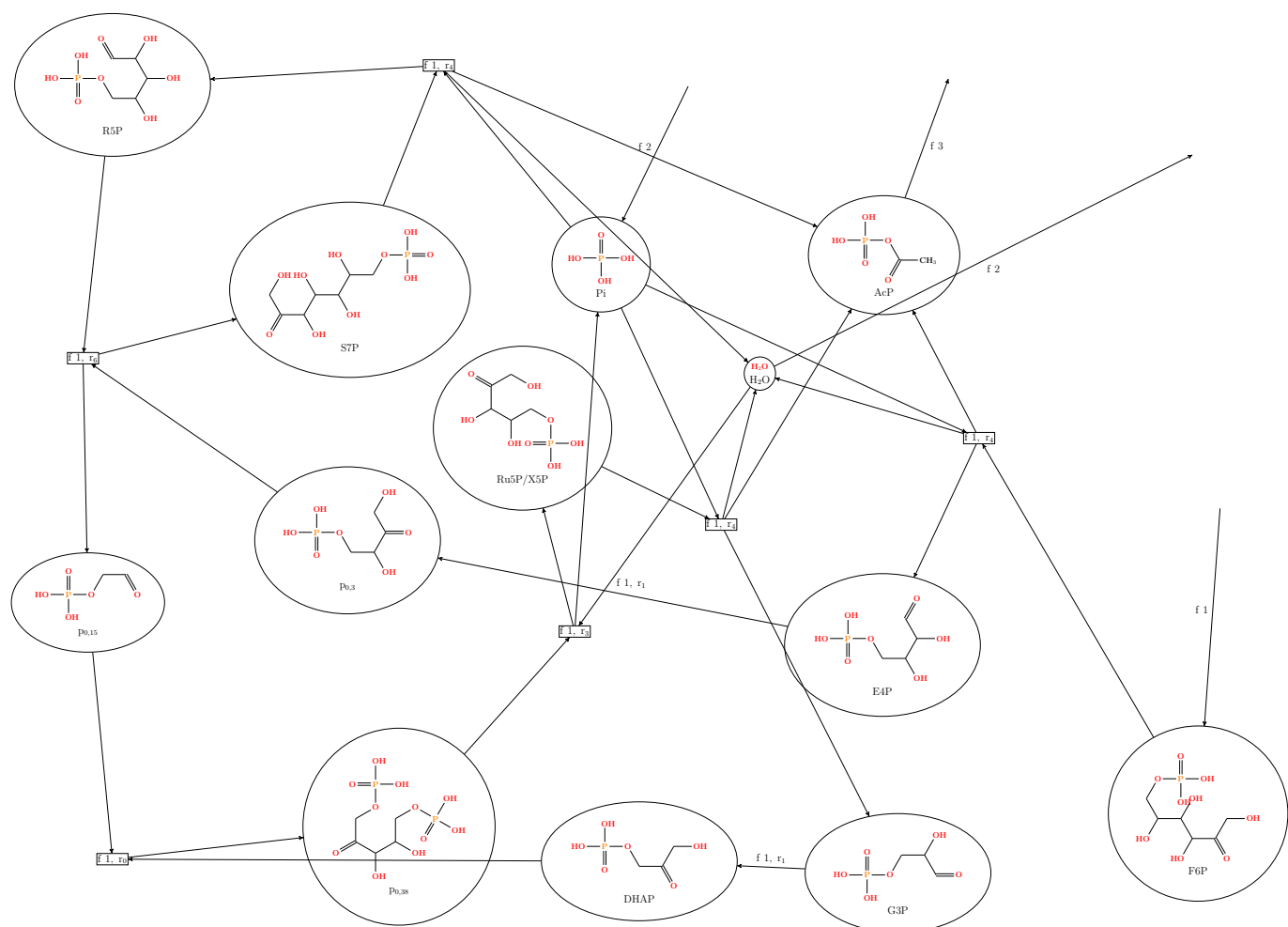
### Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0



Filtered Graph



File: out/414\_dg\_0\_11100\_f\_0\_24\_filt

$|E| = 8 \quad |P| = 8$

0.11.14 Solution 25

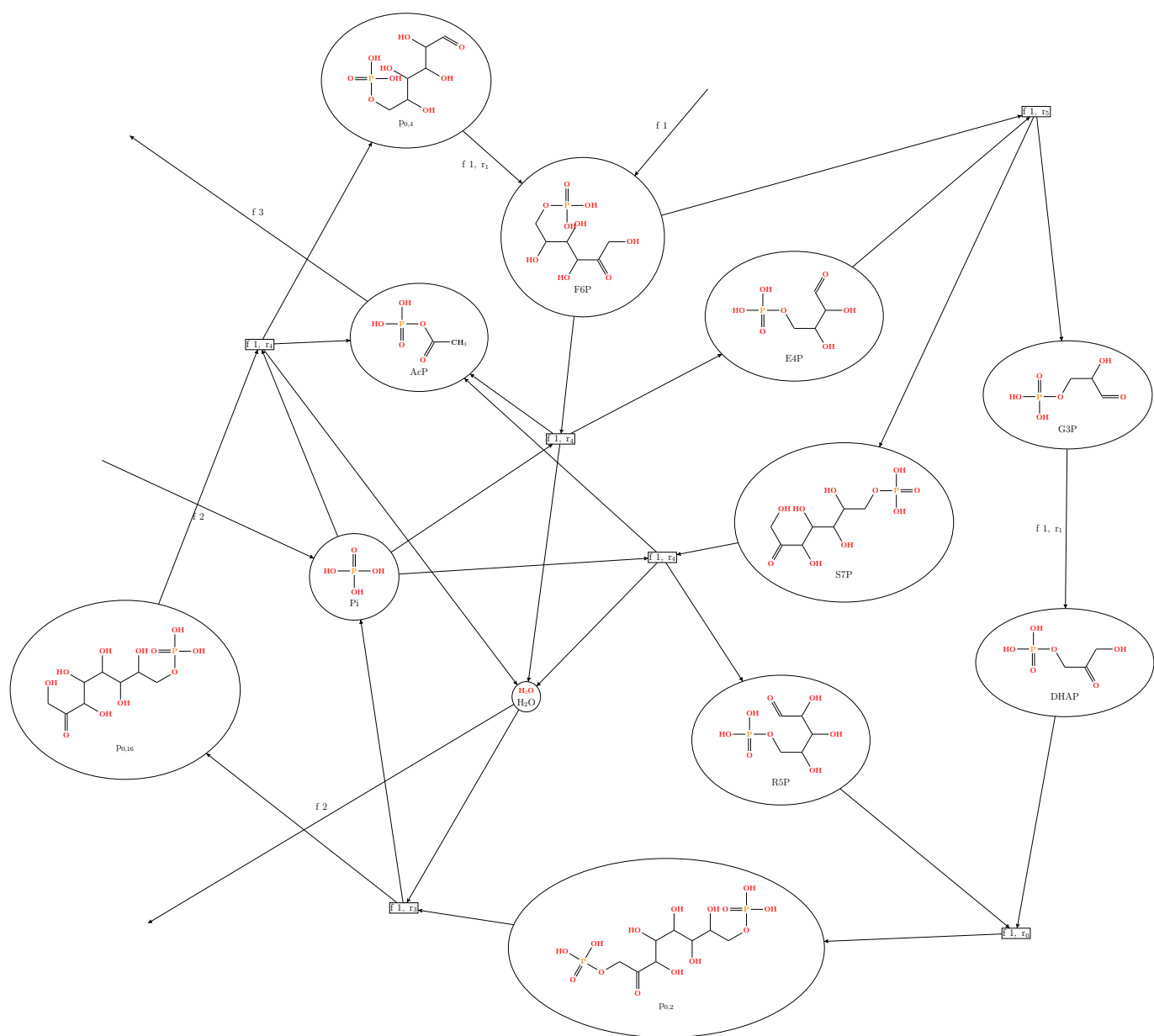
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/419\_dg\_0\_11100\_f\_0\_25\_filt

$|E| = 8 \quad |P| = 8$

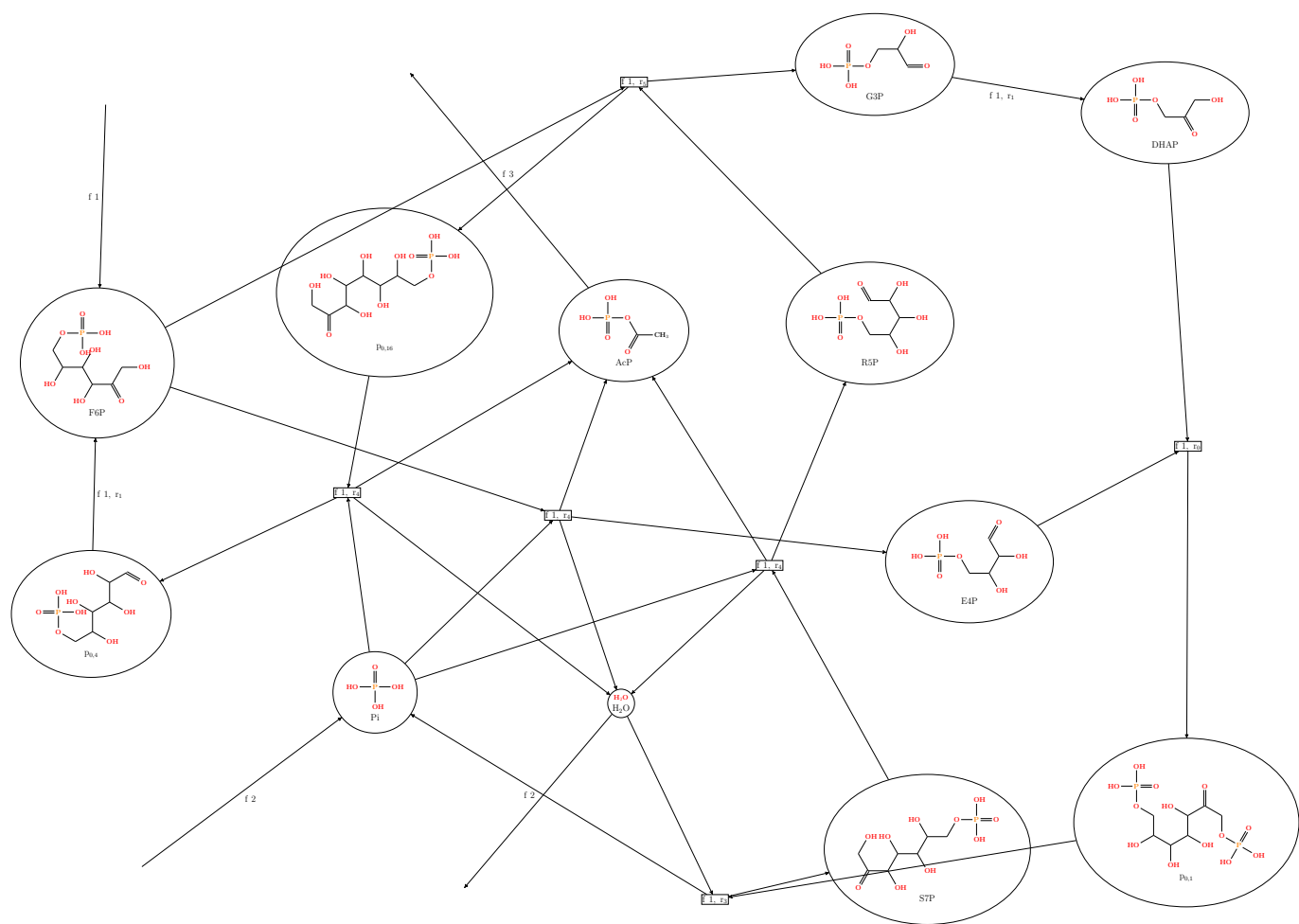
0.11.15 Solution 26

Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/424\_dg\_0\_11100\_f\_0\_26\_filt

$|E| = 8 \quad |P| = 8$

0.11.16 Solution 27

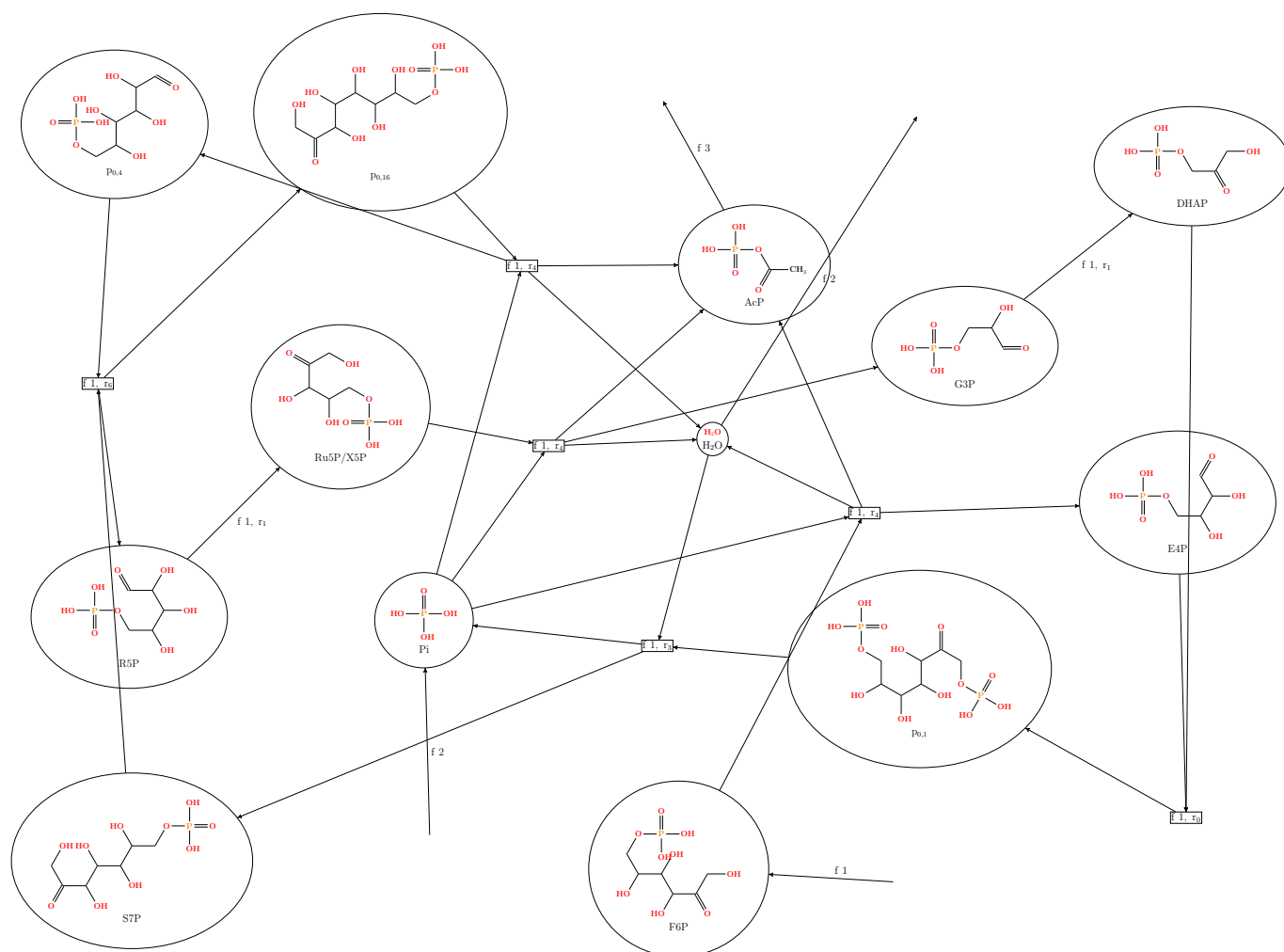
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

## Filtered Graph



File: out/429\_dg\_0\_11100\_f\_0\_27\_filt

$|E| = 8 \quad |P| = 8$

### 0.11.17 Solution 28

## Overall Data

Objective value (integral): 8

Vertex/Graph In Out

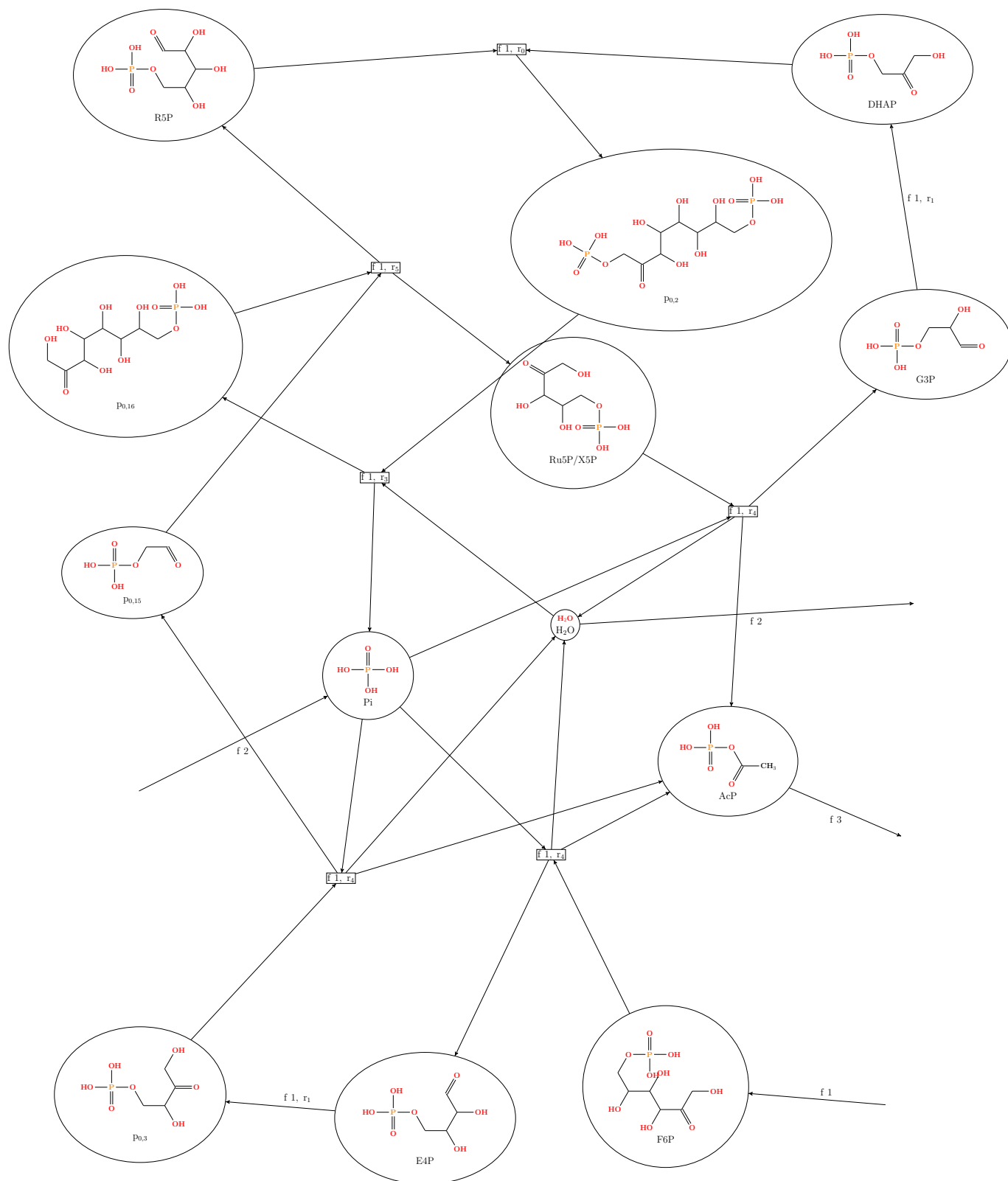
AcP 0 3

F6P	1	0
-----	---	---

H\_20                      0   2

Pi 2 0

## Filtered Graph



File: out/434\_dg\_0\_11100\_f\_0\_28\_filt

$$|E| = 8 \quad |P| = 8$$

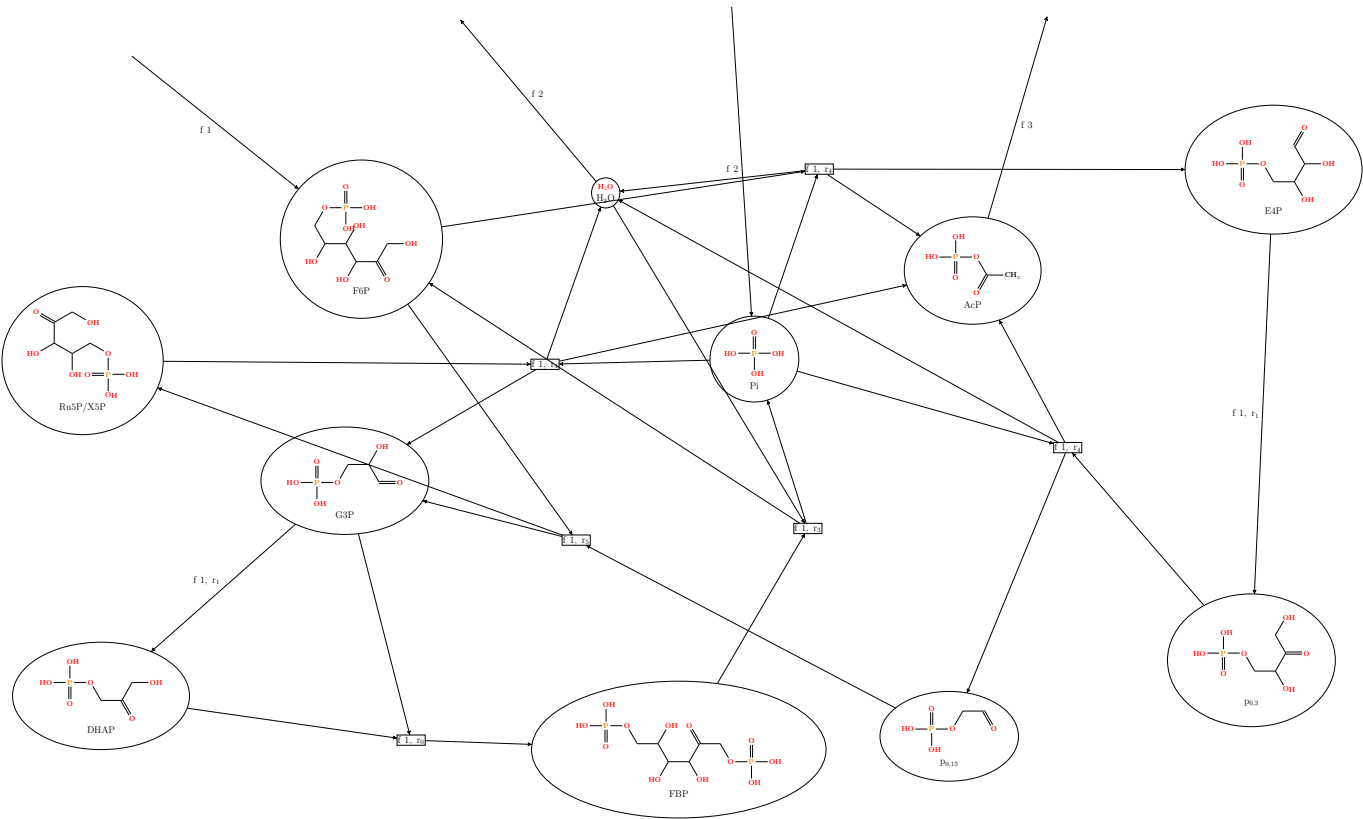
0.11.18 Solution 29

Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/439\_dg\_0\_11100\_f\_0\_29\_filt

$|E| = 8 \quad |P| = 8$

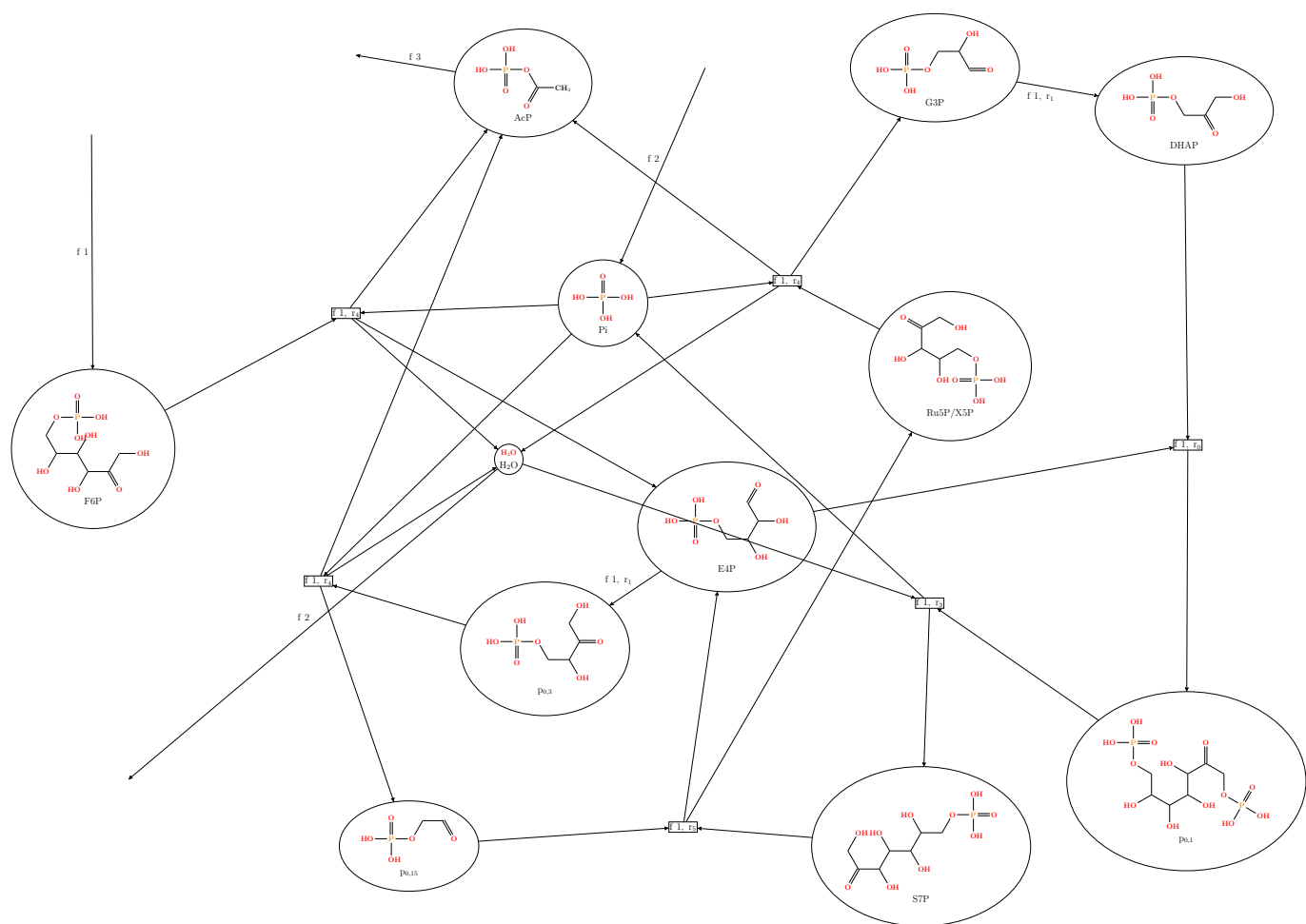
0.11.19 Solution 30

Overall Data

Objective value (integral): 8

Vertex/Graph	In	Out
AcP	0	3
F6P	1	0
H_20	0	2
Pi	2	0

Filtered Graph



File: out/444\_dg\_0\_11100\_f\_0\_30\_filt

$|E| = 8 \quad |P| = 8$

0.11.20 Solution 33

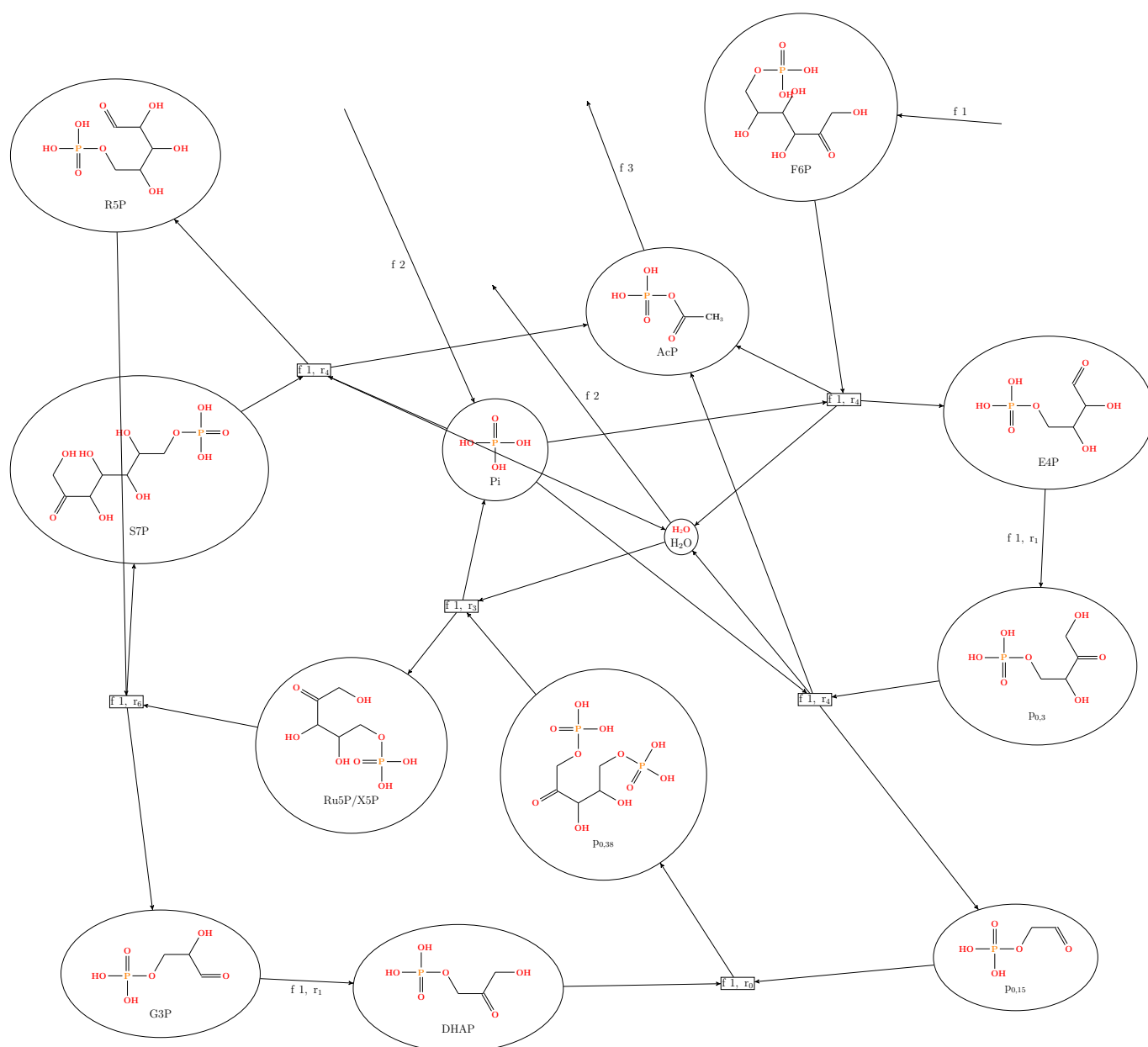
Overall Data

Objective value (integral): 8

Vertex/Graph In Out

AcP	0	3
F6P	1	0
H <sub>2</sub> O	0	2
Pi	2	0

## Filtered Graph



File: out/449\_dg\_0\_11100\_f\_0\_33\_filt

$$|E| = 8 \quad |P| = 8$$

**0.12 Enumerated Flows with 9 unique reactions**

**0.13 Enumerated Flows with 10 unique reactions**

**0.14 Enumerated Flows with 11 unique reactions**