Testing basic properties of a metabolic model (aka sanity checks)

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In this tutorial, we show how test for basic modeling properties of a metabolic model. The tutorial was developed during the construction of the generic human metabolic model, Recon 3D [1] and can be applied to Recon 3D derived condition- and cell-type specific models, to the previous generic human reconstruction, Recon2, as well as other metabolic models.

Content:

The tests include:

- leak test
- production of protons from nothing as well as from water, and/or oxygen alone
- production of matter when atp hydrolysis reaction is allowed to work but all uptakes are closed
- production of too much ATP from glucose under aerobic condition
- duplicated reactions
- empty colmuns in the model.rxnGeneMat
- the single gene deletion analysis runs smoothly
- ATP yield from different carbon sources
- metabolic objective functions
- flux consistency
- demand reactions with negative lower bound (should not occur based on definition of demand reactions)
- consistency of model.rev, which defines reaction reversibility, and the set values for the lower bounds on reactions.

All results are stored in a table ('TableChecks').

EQUIPMENT SETUP

If necessary, initialize the cobra toolbox:

```
initCobraToolbox
```

```
                                                    |
     _____   _____   _____   _____      _____       |   COnstraint-Based Reconstruction and Analysis
    /  ___| /  _  \ |  _  \ |  _  \    /  ___ \      |   The COBRA Toolbox - 2017
    | |     | | | | | |_| | | |_| |    | |___| |     |
    | |     | | | | |  _  { |  _  /    |  ___  |     |
    | |___  | |_| | | |_| | | | \ \    | |   | |     |   Documentation:
    \_____| \_____/ |_____/ |_|  \_\   |_|   |_|     |   http://opencobra.github.io/cobratoolbox
                                                    |

> Checking if git is installed ...  Done.
> Checking if the repository is tracked using git ...  Done.
> Checking if curl is installed ...  Done.
> Checking if remote can be reached ...  Done.
> Initializing and updating submodules ... Done.
> Adding all the files of The COBRA Toolbox ...  Done.
> Define CB map output... set to svg.
> Retrieving models ...   Done.
```

```
> TranslateSBML is installed and working properly.
> Configuring solver environment variables ...
  - [*---] ILOG_CPLEX_PATH: C:\Program Files\IBM\ILOG\CPLEX_Studio1263\cplex\matlab\x64_win64
  - [----] GUROBI_PATH :  --> set this path manually after installing the solver ( see instructions )
  - [*---] TOMLAB_PATH: C:\tomlab\
  - [----] MOSEK_PATH :  --> set this path manually after installing the solver ( see instructions )
  Done.
> Checking available solvers and solver interfaces ... Done.
> Setting default solvers ... Done.
> Saving the MATLAB path ... Done.
  - The MATLAB path was saved in the default location.

> Summary of available solvers and solver interfaces

    Support           LP   MILP     QP   MIQP    NLP
-------------------------------------------------------------------
cplex_direct  full              0      0      0      0      -
dqqMinos      full              0      -      -      -      -
glpk          full              1      1      -      -      -
gurobi        full              1      1      1      1      -
ibm_cplex     full              0      0      0      -      -
matlab        full              1      -      -      -      1
mosek         full              0      0      0      -      -
pdco          full              1      -      1      -      -
quadMinos     full              0      -      -      -      0
tomlab_cplex  full              1      1      1      1      -
qpng          experimental      -      -      1      -      -
tomlab_snopt  experimental      -      -      -      -      1
gurobi_mex    legacy            0      0      0      0      -
lindo_old     legacy            0      -      -      -      -
lindo_legacy  legacy            0      -      -      -      -
lp_solve      legacy            1      -      -      -      -
opti          legacy            0      0      0      0      0
-------------------------------------------------------------------
Total         -                 6      3      4      2      2

+ Legend: - = not applicable, 0 = solver not compatible or not installed, 1 = solver installed.


> You can solve LP problems using: 'glpk' - 'gurobi' - 'matlab' - 'pdco' - 'tomlab_cplex' - 'lp_solve'
> You can solve MILP problems using: 'glpk' - 'gurobi' - 'tomlab_cplex'
> You can solve QP problems using: 'gurobi' - 'pdco' - 'tomlab_cplex' - 'qpng'
> You can solve MIQP problems using: 'gurobi' - 'tomlab_cplex'
> You can solve NLP problems using: 'matlab' - 'tomlab_snopt'

> Checking for available updates ...
--> You cannot update your fork using updateCobraToolbox(). [5eb46e @ develop].
    Please use the MATLAB.devTools (https://github.com/opencobra/MATLAB.devTools).
```

For solving linear programming problems in FBA analysis, certain solvers are required:

```
% changeCobraSolver ('glpk', 'all', 1);
changeCobraSolver ('tomlab_cplex', 'all', 1);
```

```
> Tomlab interface added to MATLAB path.
> Solver for LPproblems has been set to tomlab_cplex.

> Tomlab interface added to MATLAB path.
> Solver for MILPproblems has been set to tomlab_cplex.

> Tomlab interface added to MATLAB path.
> Solver for QPproblems has been set to tomlab_cplex.

> Tomlab interface added to MATLAB path.
> Solver for MIQPproblems has been set to tomlab_cplex.
```

```
> Solver tomlab_cplex not supported for problems of type NLP. Currently used: matlab
```

This tutorial can be run with `'glpk'` package as linear programming solver, which does not require additional instalation and configuration. However, for the analysis of large models, such as Recon 3, it is not recommended to use `'glpk'` but rather industrial strenght solvers, such as the `'gurobi'` package. For detail information, refer to the solver instalation guide: https://github.com/opencobra/cobratoolbox/blob/master/docs/source/installation/solvers.md

```
warning off MATLAB:subscripting:noSubscriptsSpecified
```

PROCEDURE

Before proceeding with the simulations, the path for the model needs to be set up. In this tutorial, the used model is the generic model of human metabolism, Recon 3 [1]. If Recon 3 is not available, please use Recon 2.

```
if exist('2017_04_28_Recon3dForCurrentDistribution.mat','file')==2
    filename = '2017_04_28_Recon3dForCurrentDistribution.mat';
    load(filename);
    model=modelRecon3model;
    clear modelRecon3model;
    model.csense(1:size(model.S,1),1)='E';
else
    filename2='Recon2.0model.mat';
    if exist('Recon2.0model.mat','file')==2
        load(filename2);
        model=Recon2model;
        clear Recon2model;
        model.csense(1:size(model.S,1),1)='E';
    end
end
```

Model Harmonization

Replace reaction abbreviation for the ATP hydrolysis (DM_atp_c_) and Biomass reaction used differently in various models.

```
model.rxns(find(ismember(model.rxns,'ATPM')))={'DM_atp_c_'};
model.rxns(find(ismember(model.rxns,'ATPhyd')))={'DM_atp_c_'};
model.rxns(find(ismember(model.rxns,'DM_atp(c)')))={'DM_atp_c_'};
model.rxns(find(ismember(model.rxns,'EX_biomass_reaction')))={'biomass_reaction'};
model.rxns(find(ismember(model.rxns,'EX_biomass_maintenance')))={'biomass_maintenance'};
model.rxns(find(ismember(model.rxns,'EX_biomass_maintenance_noTrTr')))={'biomass_maintenance_r
```

Set lower bound of the biomass reaction to 0.

```
model.lb(find(ismember(model.rxns,'biomass_reaction')))=0;
model.lb(find(ismember(model.rxns,'biomass_maintenance_noTrTr')))=0;
model.lb(find(ismember(model.rxns,'biomass_maintenance')))=0;
```

Harmonize different use of brackets.

```
model.rxns = regexprep(model.rxns,'\(','\[');
model.rxns = regexprep(model.rxns,'\)','\]');
model.rxns = regexprep(model.rxns,'Ex_','EX_');
```

```
model.rxns = regexprep(model.rxns,'Sink_','sink_');
model.rxns = regexprep(model.rxns,'-','_');
```

Define some parameters that we will need.

```
cnt = 1;
tol = 1e-6;
```

Define the closed model. Here, we will set to zero the lower bounds of all reactions that represent exchange and siphon ('sink') reactions, or that contain only one entry in the column of the S matrix. The upper bound of those reactions is set to 1000 (i.e., infinity). Note that this overwrites any constraints on those reactions that may be present in a condition- and cell-type specific model.

```
modelClosed = model;
modelexchanges1 = strmatch('Ex_',modelClosed.rxns);
modelexchanges4 = strmatch('EX_',modelClosed.rxns);
modelexchanges2 = strmatch('DM_',modelClosed.rxns);
modelexchanges3 = strmatch('sink_',modelClosed.rxns);
selExc = (find( full((sum(abs(modelClosed.S)==1,1) ==1) & (sum(modelClosed.S~=0) == 1))))';

modelexchanges = unique([modelexchanges1;modelexchanges2;modelexchanges3;modelexchanges4;selEx
modelClosed.lb(find(ismember(modelClosed.rxns,modelClosed.rxns(modelexchanges))))=0;
modelClosed.ub(find(ismember(modelClosed.rxns,modelClosed.rxns(modelexchanges))))=1000;
modelClosedOri = modelClosed;
```

Start with tests.

Perform leak test, i.e., whether the closed model can produce any exchanged metabolite, as defined in the model, from nothing.

```
modelClosed = modelClosedOri;
[LeakRxns,modelTested,LeakRxnsFluxVector] = fastLeakTest(modelClosed,modelClosed.rxns(selExc),
```

```
TestRxnNum = 1806
ObjValue = 2.7489e-10
```

```
TableChecks{cnt,1} = 'fastLeakTest 1';
if length(LeakRxns)>0
    warning('model leaks metabolites!')
    TableChecks{cnt,2} = 'Model leaks metabolites!';
else
    TableChecks{cnt,2} = 'Leak free!';
end
cnt = cnt + 1;
```

Test if something leaks when demand reactions for each metabolite in the model are added. Note that this step is time consuming.

```
modelClosed = modelClosedOri;
[LeakRxnsDM,modelTestedDM,LeakRxnsFluxVectorDM] = fastLeakTest(modelClosed,modelClosed.rxns(se
```

```
DM_10fthf5glu[c] 10fthf5glu[c]  ->
DM_10fthf5glu[l] 10fthf5glu[l]  ->
DM_10fthf5glu[m] 10fthf5glu[m]  ->
DM_10fthf6glu[c] 10fthf6glu[c]  ->
DM_10fthf6glu[l] 10fthf6glu[l]  ->
```

```
DM_10fthf6glu[m] 10fthf6glu[m]  ->
DM_10fthf7glu[c] 10fthf7glu[c]  ->
DM_10fthf7glu[l] 10fthf7glu[l]  ->
DM_10fthf7glu[m] 10fthf7glu[m]  ->
DM_10fthf[c] 10fthf[c]  ->
DM_10fthf[l] 10fthf[l]  ->
DM_10fthf[m] 10fthf[m]  ->
DM_11docrtsl[c] 11docrtsl[c]  ->
DM_11docrtsl[m] 11docrtsl[m]  ->
DM_11docrtsl[r] 11docrtsl[r]  ->
DM_11docrtstrn[c] 11docrtstrn[c]  ->
DM_11docrtstrn[m] 11docrtstrn[m]  ->
DM_11docrtstrn[r] 11docrtstrn[r]  ->
DM_13dampp[c] 13dampp[c]  ->
DM_h2o[c] h2o[c]  ->
DM_o2[c] o2[c]  ->
DM_bamppald[c] bamppald[c]  ->
DM_h2o2[c] h2o2[c]  ->
DM_nh4[c] nh4[c]  ->
DM_h2o[m] h2o[m]  ->
DM_o2[m] o2[m]  ->
DM_2425dhvitd2[m] 2425dhvitd2[m]  ->
DM_h[m] h[m]  ->
DM_nadph[m] nadph[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_1a2425thvitd2[m] 1a2425thvitd2[m]  ->
DM_nadp[m] nadp[m]  ->
DM_2425dhvitd3[m] 2425dhvitd3[m]  ->
DM_1a25dhvitd2[m] 1a25dhvitd2[m]  ->
DM_1a25dhvitd3[m] 1a25dhvitd3[m]  ->
DM_h[c] h[c]  ->
DM_1mncam[c] 1mncam[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1mncam[e]
DM_atp[c] atp[c]  ->
DM_adp[c] adp[c]  ->
DM_pi[c] pi[c]  ->
DM_h[x] h[x]  ->
DM_1pipdn2c[x] 1pipdn2c[x]  ->
DM_nadh[x] nadh[x]  ->
DM_Lpipecol[x] Lpipecol[x]  ->
DM_nad[x] nad[x]  ->
DM_2425dhvitd2[c] 2425dhvitd2[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2425dhvitd2[e]
DM_2425dhvitd3[c] 2425dhvitd3[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2425dhvitd3[e]
DM_25hvitd2[m] 25hvitd2[m]  ->
DM_25hvitd3[m] 25hvitd3[m]  ->
Warning: Model already has the same reaction you tried to add: EX_24nph[e]
DM_24nph[c] 24nph[c]  ->
Warning: Model already has the same reaction you tried to add: sink_25hvitd2[c]
Warning: Model already has the same reaction you tried to add: EX_25hvitd2[e]
DM_25hvitd3[c] 25hvitd3[c]  ->
Warning: Model already has the same reaction you tried to add: EX_25hvitd3[e]
DM_2amac[c] 2amac[c]  ->
DM_pyr[c] pyr[c]  ->
DM_nadph[c] nadph[c]  ->
Warning: Model already has the same reaction you tried to add: sink_nadp[c]
DM_paps[c] paps[c]  ->
DM_Lcyst[c] Lcyst[c]  ->
DM_pap[c] pap[c]  ->
DM_L2aadp[c] L2aadp[c]  ->
DM_L2aadp[m] L2aadp[m]  ->
DM_akg[m] akg[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
DM_akg[c] akg[c]  ->
DM_2dr1p[c] 2dr1p[c]  ->
DM_drib[c] drib[c]  ->
DM_nadh[c] nadh[c]  ->
Warning: Model already has the same reaction you tried to add: sink_nad[c]

DM_2hb[c] 2hb[c]  ->
DM_2obut[c] 2obut[c]  ->
Warning: Model already has the same reaction you tried to add: EX_h[e]
Warning: Model already has the same reaction you tried to add: EX_2hb[e]
Warning: Model already has the same reaction you tried to add: EX_hco3[e]

DM_hco3[c] hco3[c]  ->
Warning: Model already has the same reaction you tried to add: EX_na1[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_na1[c] na1[c]  ->
DM_2mcit[c] 2mcit[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2mcit[e]

DM_nadh[m] nadh[m]  ->
DM_nad[m] nad[m]  ->
DM_2oxoadp[m] 2oxoadp[m]  ->
DM_coa[m] coa[m]  ->
DM_co2[m] co2[m]  ->
DM_glutcoa[m] glutcoa[m]  ->
DM_2oxoadp[c] 2oxoadp[c]  ->
DM_34dhmald[c] 34dhmald[c]  ->
DM_34dhoxpeg[c] 34dhoxpeg[c]  ->
Warning: Model already has the same reaction you tried to add: EX_34dhoxpeg[e]

DM_34dhpha[c] 34dhpha[c]  ->
DM_amet[c] amet[c]  ->
DM_ahcys[c] ahcys[c]  ->
DM_homoval[c] homoval[c]  ->
Warning: Model already has the same reaction you tried to add: EX_34dhphe[e]

DM_34dhphe[c] 34dhphe[c]  ->
Warning: Model already has the same reaction you tried to add: sink_34dhpac[c]

DM_34dhoxmand[c] 34dhoxmand[c]  ->
DM_34hpp[m] 34hpp[m]  ->
DM_34hpl[m] 34hpl[m]  ->
DM_co2[c] co2[c]  ->
DM_34hpp[c] 34hpp[c]  ->
DM_hgentis[c] hgentis[c]  ->
DM_35cgmp[c] 35cgmp[c]  ->
DM_35cgmp[n] 35cgmp[n]  ->
DM_3aib[m] 3aib[m]  ->
DM_2mop[m] 2mop[m]  ->
DM_glu_L[m] glu_L[m]  ->
DM_3aib[c] 3aib[c]  ->
DM_3dphb[m] 3dphb[m]  ->
DM_3dpdhb[m] 3dpdhb[m]  ->
DM_3dsphgn[c] 3dsphgn[c]  ->
DM_sphgn[c] sphgn[c]  ->
DM_3hanthrn[c] 3hanthrn[c]  ->
DM_cmusa[c] cmusa[c]  ->
DM_b2coa[m] b2coa[m]  ->
DM_3hbcoa_R[m] 3hbcoa_R[m]  ->
DM_3hibutcoa[m] 3hibutcoa[m]  ->
DM_3hmp[m] 3hmp[m]  ->
Warning: Model already has the same reaction you tried to add: sink_glu_L[c]

DM_hLkynr[c] hLkynr[c]  ->
DM_42A3HP24DB[c] 42A3HP24DB[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_dopa[c] dopa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_coa[c]

DM_3hpp[c] 3hpp[c]  ->
```

```
DM_3mox4hpac[c] 3mox4hpac[c]  ->
DM_3mlda[c] 3mlda[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3mlda[e]

DM_3mob[c] 3mob[c]  ->
DM_3mob[m] 3mob[m]  ->
DM_3mop[c] 3mop[c]  ->
DM_3mop[m] 3mop[m]  ->
DM_3m4hpga[c] 3m4hpga[c]  ->
DM_3mox4hoxm[c] 3mox4hoxm[c]  ->
DM_3moxtyr[c] 3moxtyr[c]  ->
DM_h2o[l] h2o[l]  ->
DM_pi[l] pi[l]  ->
DM_adn[l] adn[l]  ->
DM_3sala[m] 3sala[m]  ->
DM_3sala[c] 3sala[c]  ->
Warning: Model already has the same reaction you tried to add: sink_asp_L[c]

DM_asp_L[m] asp_L[m]  ->
DM_hyptaur[c] hyptaur[c]  ->
DM_3snpyr[c] 3snpyr[c]  ->
DM_3snpyr[m] 3snpyr[m]  ->
DM_so3[c] so3[c]  ->
DM_pyr[m] pyr[m]  ->
DM_so3[m] so3[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_adrnl[c] adrnl[c]  ->
DM_mma[c] mma[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_nrpphr[c] nrpphr[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_4abut[c] 4abut[c]  ->
DM_4abut[m] 4abut[m]  ->
DM_coucoa[m] coucoa[m]  ->
DM_4hbzcoa[m] 4hbzcoa[m]  ->
DM_accoa[m] accoa[m]  ->
DM_4hbz[m] 4hbz[m]  ->
Warning: Model already has the same reaction you tried to add: EX_4hdebrisoquine[e]

DM_4hdebrisoquine[c] 4hdebrisoquine[c]  ->
DM_4hglusa[m] 4hglusa[m]  ->
DM_e4hglu[m] e4hglu[m]  ->
DM_4hoxpacd[c] 4hoxpacd[c]  ->
DM_4hphac[c] 4hphac[c]  ->
DM_4mop[c] 4mop[c]  ->
DM_4mop[m] 4mop[m]  ->
DM_4mptnl[c] 4mptnl[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4mptnl[e]

DM_4mptnl[m] 4mptnl[m]  ->
Warning: Model already has the same reaction you tried to add: EX_4mtolbutamide[e]

DM_4mtolbutamide[c] 4mtolbutamide[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4nphsf[e]

DM_4nphsf[c] 4nphsf[c]  ->
DM_4nph[c] 4nph[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4nph[e]

DM_4pyrdx[c] 4pyrdx[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4pyrdx[e]

DM_5adtststeroneglc[c] 5adtststeroneglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5adtststeroneglc[e]

DM_5adtststeroneglc[r] 5adtststeroneglc[r]  ->
DM_5adtststerones[c] 5adtststerones[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5adtststerones[e]

DM_5adtststerone[c] 5adtststerone[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5adtststerone[e]
```

```
DM_5adtststerone[r] 5adtststerone[r]  ->
DM_5aop[c] 5aop[c]  ->
DM_5aop[m] 5aop[m]  ->
DM_5dhf[c] 5dhf[c]  ->
DM_5dhf[l] 5dhf[l]  ->
Warning: Model already has the same reaction you tried to add: EX_h2o[e]
Warning: Model already has the same reaction you tried to add: EX_5fthf[e]
DM_5fthf[c] 5fthf[c]  ->
DM_5htrp[c] 5htrp[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_srtn[c] srtn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5homeprazole[e]
DM_5homeprazole[c] 5homeprazole[c]  ->
DM_5hoxindact[c] 5hoxindact[c]  ->
DM_5hoxindoa[c] 5hoxindoa[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5htrp[e]
Warning: Model already has the same reaction you tried to add: EX_5mthf[e]
DM_5mthf[c] 5mthf[c]  ->
DM_5thf[c] 5thf[c]  ->
DM_5thf[l] 5thf[l]  ->
DM_5thf[m] 5thf[m]  ->
DM_6dhf[c] 6dhf[c]  ->
DM_6dhf[l] 6dhf[l]  ->
DM_6dhf[m] 6dhf[m]  ->
DM_6htststerone[c] 6htststerone[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6htststerone[e]
DM_6htststerone[r] 6htststerone[r]  ->
DM_6thf[c] 6thf[c]  ->
DM_6thf[l] 6thf[l]  ->
DM_6thf[m] 6thf[m]  ->
DM_7dhchsterol[r] 7dhchsterol[r]  ->
DM_7dhchsterol[c] 7dhchsterol[c]  ->
DM_7dhf[c] 7dhf[c]  ->
DM_7dhf[l] 7dhf[l]  ->
DM_7dhf[m] 7dhf[m]  ->
DM_7thf[c] 7thf[c]  ->
DM_7thf[l] 7thf[l]  ->
DM_7thf[m] 7thf[m]  ->
DM_man[c] man[c]  ->
DM_m2mn[l] m2mn[l]  ->
DM_man[l] man[l]  ->
DM_mn[l] mn[l]  ->
DM_galgluside_hs[c] galgluside_hs[c]  ->
DM_udpgal[c] udpgal[c]  ->
DM_thcrm_hs[c] thcrm_hs[c]  ->
DM_udp[c] udp[c]  ->
DM_h[g] h[g]  ->
DM_galgluside_hs[g] galgluside_hs[g]  ->
DM_udpgal[g] udpgal[g]  ->
DM_thcrm_hs[g] thcrm_hs[g]  ->
DM_udp[g] udp[g]  ->
Warning: Model already has the same reaction you tried to add: DM_T_antigen_g_
DM_uacgam[g] uacgam[g]  ->
DM_gncore1[g] gncore1[g]  ->
DM_core2[g] core2[g]  ->
Warning: Model already has the same reaction you tried to add: DM_gncore2_g_
DM_aact[c] aact[c]  ->
DM_mthgxl[c] mthgxl[c]  ->
DM_aact[m] aact[m]  ->
DM_L2aadp6sa[m] L2aadp6sa[m]  ->
DM_fucgalacglcgalgluside_hs[g] fucgalacglcgalgluside_hs[g]  ->
DM_udpacgal[g] udpacgal[g]  ->
DM_acgalfucgalacglcgalgluside_hs[g] acgalfucgalacglcgalgluside_hs[g]  ->
```

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DM_galfucgalacglcgalgluside_hs[g] galfucgalacglcgalgluside_hs[g]  ->
DM_fuc12gal14acglcgalgluside_hs[g] fuc12gal14acglcgalgluside_hs[g]  ->
DM_galfuc12gal14acglcgalgluside_hs[g] galfuc12gal14acglcgalgluside_hs[g]  ->
DM_acgalfuc12gal14acglcgalgluside_hs[g] acgalfuc12gal14acglcgalgluside_hs[g]  ->
DM_fucgalacgalfuc12gal14acglcgalgluside_hs[g] fucgalacgalfuc12gal14acglcgalgluside_hs[g]  ->
DM_acgalfucgalacgalfuc12gal14acglcgalgluside_hs[g] acgalfucgalacgalfuc12gal14acglcgalgluside_hs[g]  ->
DM_fucgalacglcgal14acglcgalgluside_hs[g] fucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_acgalfucgalacglcgal14acglcgalgluside_hs[g] acgalfucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_fucgalacgalfucgalacglcgal14acglcgalgluside_hs[g] fucgalacgalfucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_acgalfucgalacgalfucgalacglcgal14acglcgalgluside_hs[g] acgalfucgalacgalfucgalacglcgal14acglcgalgluside
DM_galfucgalacglcgal14acglcgalgluside_hs[g] galfucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_fucfucgalacglcgalacglcgal14acglcgalgluside_hs[g] fucfucgalacglcgalacglcgal14acglcgalgluside_hs[g]  ->
DM_galgalfucfucgalacglcgalacglcgal14acglcgalgluside_hs[g] galgalfucfucgalacglcgalacglcgal14acglcgalglusi
DM_sucsal[m] sucsal[m]  ->
DM_abt[c] abt[c]  ->
DM_xylu_L[c] xylu_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_abt[e]

DM_h[l] h[l]  ->
Warning: Model already has the same reaction you tried to add: sink_4abut[l]
Warning: Model already has the same reaction you tried to add: EX_4abut[e]

DM_2maacoa[m] 2maacoa[m]  ->
DM_ppcoa[m] ppcoa[m]  ->
DM_aacoa[m] aacoa[m]  ->
DM_coa[x] coa[x]  ->
DM_accoa[x] accoa[x]  ->
DM_aacoa[x] aacoa[x]  ->
DM_acac[c] acac[c]  ->
DM_acac[m] acac[m]  ->
DM_3odcoa[x] 3odcoa[x]  ->
DM_occoa[x] occoa[x]  ->
DM_3oddcoa[x] 3oddcoa[x]  ->
DM_dcacoa[x] dcacoa[x]  ->
DM_3otdcoa[x] 3otdcoa[x]  ->
DM_ddcacoa[x] ddcacoa[x]  ->
DM_3ohdcoa[x] 3ohdcoa[x]  ->
DM_tdcoa[x] tdcoa[x]  ->
DM_3ohodcoa[x] 3ohodcoa[x]  ->
DM_pmtcoa[x] pmtcoa[x]  ->
DM_3ohxccoa[x] 3ohxccoa[x]  ->
DM_ttccoa[x] ttccoa[x]  ->
DM_acac[x] acac[x]  ->
DM_acald[m] acald[m]  ->
DM_acald[c] acald[c]  ->
DM_acald[r] acald[r]  ->
DM_acald[x] acald[x]  ->
DM_atp[m] atp[m]  ->
DM_adp[m] adp[m]  ->
DM_pi[m] pi[m]  ->
DM_hco3[m] hco3[m]  ->
DM_malcoa[m] malcoa[m]  ->
DM_accoa[c] accoa[c]  ->
DM_accoa[g] accoa[g]  ->
DM_amp[m] amp[m]  ->
DM_ppi[m] ppi[m]  ->
DM_ppa[m] ppa[m]  ->
DM_accoa[n] accoa[n]  ->
DM_accoa[r] accoa[r]  ->
Warning: Model already has the same reaction you tried to add: EX_acetone[e]

DM_acetone[c] acetone[c]  ->
DM_acetone[m] acetone[m]  ->
DM_acgagbside_hs[c] acgagbside_hs[c]  ->
DM_acgagbside_hs[g] acgagbside_hs[g]  ->
DM_acgagbside_hs[l] acgagbside_hs[l]  ->
Warning: Model already has the same reaction you tried to add:
EX_acgalfucgalacgalfuc12gal14acglcgalgluside_hs[e]
```

```
DM_acgalfucgalacgalfuc12gal14acglcgalgluside_hs[c] acgalfucgalacgalfuc12gal14acglcgalgluside_hs[c]  ->
Warning: Model already has the same reaction you tried to add:
EX_acgalfucgalacgalfucgalacglcgal14acglcgalgluside_hs[e]
```

```
DM_acgalfucgalacgalfucgalacglcgal14acglcgalgluside_hs[c] acgalfucgalacgalfucgalacglcgal14acglcgalgluside
DM_acgal[c] acgal[c]  ->
DM_acgal1p[c] acgal1p[c]  ->
DM_itp[c] itp[c]  ->
DM_idp[c] idp[c]  ->
DM_acgal[g] acgal[g]  ->
DM_acgal[l] acgal[l]  ->
DM_gam6p[c] gam6p[c]  ->
DM_acgam6p[c] acgam6p[c]  ->
DM_acgam[c] acgam[c]  ->
DM_acgam1p[c] acgam1p[c]  ->
DM_acgam[l] acgam[l]  ->
DM_acgbgbside_hs[c] acgbgbside_hs[c]  ->
DM_acgbgbside_hs[g] acgbgbside_hs[g]  ->
DM_acgbgbside_hs[l] acgbgbside_hs[l]  ->
DM_acgpail_hs[c] acgpail_hs[c]  ->
DM_ac[c] ac[c]  ->
DM_gpail_hs[c] gpail_hs[c]  ->
DM_acglu[m] acglu[m]  ->
Warning: Model already has the same reaction you tried to add: EX_ac[e]
Warning: Model already has the same reaction you tried to add: EX_ach[e]
Warning: Model already has the same reaction you tried to add: EX_chol[e]
```

```
DM_ach[n] ach[n]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
DM_ach[c] ach[c]  ->
DM_cit[c] cit[c]  ->
DM_oaa[c] oaa[c]  ->
DM_acn13acngalgbside_hs[c] acn13acngalgbside_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acn13acngalgbside_hs[e]
```

```
DM_acn13acngalgbside_hs[g] acn13acngalgbside_hs[g]  ->
DM_acn23acngalgbside_hs[c] acn23acngalgbside_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acn23acngalgbside_hs[e]
```

```
DM_acn23acngalgbside_hs[g] acn23acngalgbside_hs[g]  ->
Warning: Model already has the same reaction you tried to add:
EX_acnacngal14acglcgalgluside_hs[e]
```

```
DM_acnacngal14acglcgalgluside_hs[c] acnacngal14acglcgalgluside_hs[c]  ->
DM_acnacngal14acglcgalgluside_hs[g] acnacngal14acglcgalgluside_hs[g]  ->
DM_acnacngalgbside_hs[c] acnacngalgbside_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acnacngalgbside_hs[e]
```

```
DM_acnacngalgbside_hs[g] acnacngalgbside_hs[g]  ->
DM_acmanap[c] acmanap[c]  ->
DM_pep[c] pep[c]  ->
DM_acnamp[c] acnamp[c]  ->
DM_man6p[c] man6p[c]  ->
DM_kdnp[c] kdnp[c]  ->
DM_acnam[c] acnam[c]  ->
DM_acnam[l] acnam[l]  ->
DM_acnam[n] acnam[n]  ->
Warning: Model already has the same reaction you tried to add:
EX_acngalacglcgal14acglcgalgluside_hs[e]
```

```
DM_acngalacglcgal14acglcgalgluside_hs[c] acngalacglcgal14acglcgalgluside_hs[c]  ->
DM_acngalacglcgal14acglcgalgluside_hs[g] acngalacglcgal14acglcgalgluside_hs[g]  ->
DM_acmana[c] acmana[c]  ->
DM_2mbcoa[m] 2mbcoa[m]  ->
DM_fad[m] fad[m]  ->
DM_2mb2coa[m] 2mb2coa[m]  ->
DM_fadh2[m] fadh2[m]  ->
DM_btcoa[m] btcoa[m]  ->
DM_ivcoa[m] ivcoa[m]  ->
DM_3mb2coa[m] 3mb2coa[m]  ->
```

```
DM_ibcoa[m] ibcoa[m]  ->
DM_2mp2coa[m] 2mp2coa[m]  ->
DM_o2[x] o2[x]  ->
DM_h2o2[x] h2o2[x]  ->
DM_hdd2coa[x] hdd2coa[x]  ->
DM_acorn[c] acorn[c]  ->
DM_orn[c] orn[c]  ->
DM_cit[m] cit[m]  ->
DM_icit[m] icit[m]  ->
DM_fad[x] fad[x]  ->
DM_fadh2[x] fadh2[x]  ->
DM_dhcholoylcoa[x] dhcholoylcoa[x]  ->
DM_thcholoylcoa[x] thcholoylcoa[x]  ->
DM_h2o[x] h2o[x]  ->
DM_cholcoas[x] cholcoas[x]  ->
DM_cholcoads[x] cholcoads[x]  ->
DM_fmn[c] fmn[c]  ->
DM_ribflv[c] ribflv[c]  ->
DM_acrn[c] acrn[c]  ->
DM_acrn[m] acrn[m]  ->
DM_amp[c] amp[c]  ->
DM_ppi[c] ppi[c]  ->
DM_ppcoa[c] ppcoa[c]  ->
DM_ppa[c] ppa[c]  ->
DM_ac[m] ac[m]  ->
DM_Nacsertn[c] Nacsertn[c]  ->
DM_melatn[c] melatn[c]  ->
DM_ac[g] ac[g]  ->
DM_acetol[c] acetol[c]  ->
DM_adn[c] adn[c]  ->
DM_ins[c] ins[c]  ->
Warning: Model already has the same reaction you tried to add: EX_nh4[e]
Warning: Model already has the same reaction you tried to add: EX_adn[e]
Warning: Model already has the same reaction you tried to add: EX_ins[e]
Warning: Model already has the same reaction you tried to add: EX_ade[e]
DM_ade[c] ade[c]  ->
DM_gtp[c] gtp[c]  ->
DM_gdp[c] gdp[c]  ->
DM_gtp[m] gtp[m]  ->
DM_gdp[m] gdp[m]  ->
DM_damp[c] damp[c]  ->
DM_datp[c] datp[c]  ->
DM_dadp[c] dadp[c]  ->
DM_ametam[c] ametam[c]  ->
DM_camp[c] camp[c]  ->
DM_adn[m] adn[m]  ->
DM_g1p[c] g1p[c]  ->
DM_adpman[c] adpman[c]  ->
DM_man1p[c] man1p[c]  ->
Warning: Model already has the same reaction you tried to add: EX_adprib[e]
DM_adprib[c] adprib[c]  ->
DM_adp[x] adp[x]  ->
DM_adrncoa[c] adrncoa[c]  ->
DM_adrncoa[x] adrncoa[x]  ->
DM_crn[c] crn[c]  ->
DM_adrncrn[c] adrncrn[c]  ->
DM_adrncoa[m] adrncoa[m]  ->
DM_crn[m] crn[m]  ->
DM_adrncrn[m] adrncrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_adrnl[e]
Warning: Model already has the same reaction you tried to add: EX_adrn[e]
DM_adrn[c] adrn[c]  ->
DM_aps[c] aps[c]  ->
DM_dcamp[c] dcamp[c]  ->
DM_fum[c] fum[c]  ->
```

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DM_25aics[c] 25aics[c]  ->
DM_aicar[c] aicar[c]  ->
Warning: Model already has the same reaction you tried to add: EX_aflatoxin[e]
DM_aflatoxin[c] aflatoxin[c]  ->
DM_ksii_core4_pre2[g] ksii_core4_pre2[g]  ->
DM_ksii_core4_pre3[g] ksii_core4_pre3[g]  ->
DM_ksii_core4_pre4[g] ksii_core4_pre4[g]  ->
DM_ksii_core4_pre5[g] ksii_core4_pre5[g]  ->
DM_ksii_core4_pre7[g] ksii_core4_pre7[g]  ->
DM_ksii_core4_pre8[g] ksii_core4_pre8[g]  ->
DM_ksii_core2_pre2[g] ksii_core2_pre2[g]  ->
DM_ksii_core2_pre3[g] ksii_core2_pre3[g]  ->
DM_ksii_core2_pre4[g] ksii_core2_pre4[g]  ->
DM_ksii_core2_pre5[g] ksii_core2_pre5[g]  ->
DM_ksii_core2_pre7[g] ksii_core2_pre7[g]  ->
DM_ksii_core2_pre8[g] ksii_core2_pre8[g]  ->
DM_cdpchol[c] cdpchol[c]  ->
DM_cmp[c] cmp[c]  ->
DM_cdpea[c] cdpea[c]  ->
DM_Rtotal2[c] Rtotal2[c]  ->
DM_agm[m] agm[m]  ->
DM_ptrc[m] ptrc[m]  ->
DM_urea[m] urea[m]  ->
DM_Rtotal2coa[c] Rtotal2coa[c]  ->
DM_alpa_hs[c] alpa_hs[c]  ->
DM_pa_hs[c] pa_hs[c]  ->
DM_ala_L[m] ala_L[m]  ->
DM_glx[m] glx[m]  ->
DM_gly[m] gly[m]  ->
DM_pyr[x] pyr[x]  ->
DM_ala_L[x] ala_L[x]  ->
DM_glx[x] glx[x]  ->
DM_gly[x] gly[x]  ->
DM_ahandrostanglc[c] ahandrostanglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ahandrostanglc[e]
DM_ahandrostanglc[r] ahandrostanglc[r]  ->
DM_ahcys[r] ahcys[r]  ->
DM_n2m2nmn[l] n2m2nmn[l]  ->
DM_n2m2mn[l] n2m2mn[l]  ->
DM_air[c] air[c]  ->
DM_5aizc[c] 5aizc[c]  ->
DM_succoa[m] succoa[m]  ->
DM_mal_L[c] mal_L[c]  ->
DM_mal_L[m] mal_L[m]  ->
Warning: Model already has the same reaction you tried to add: EX_akg[e]
DM_akg[x] akg[x]  ->
DM_prgstrn[c] prgstrn[c]  ->
DM_aprgstrn[c] aprgstrn[c]  ->
DM_xol7ah[c] xol7ah[c]  ->
DM_xol7ah2[c] xol7ah2[c]  ->
DM_xoldioloneh[c] xoldioloneh[c]  ->
DM_xoltriol[c] xoltriol[c]  ->
Warning: Model already has the same reaction you tried to add: sink_xol7aone[c]
Warning: Model already has the same reaction you tried to add: sink_xoldiolone[c]
Warning: Model already has the same reaction you tried to add: EX_ala_L[e]
Warning: Model already has the same reaction you tried to add: sink_ala_L[c]
Warning: Model already has the same reaction you tried to add: sink_asn_L[c]
Warning: Model already has the same reaction you tried to add: EX_asn_L[e]
Warning: Model already has the same reaction you tried to add: sink_cys_L[c]
Warning: Model already has the same reaction you tried to add: EX_cys_L[e]
Warning: Model already has the same reaction you tried to add: EX_ala_D[e]
DM_ala_D[c] ala_D[c]  ->
Warning: Model already has the same reaction you tried to add: sink_gln_L[c]
Warning: Model already has the same reaction you tried to add: EX_gln_L[e]
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Warning: Model already has the same reaction you tried to add: sink_gly[c]
Warning: Model already has the same reaction you tried to add: EX_gly[e]
Warning: Model already has the same reaction you tried to add: sink_ser_L[c]
Warning: Model already has the same reaction you tried to add: EX_ser_L[e]
Warning: Model already has the same reaction you tried to add: sink_thr_L[c]
Warning: Model already has the same reaction you tried to add: EX_thr_L[e]

DM_12ppd_R[c] 12ppd_R[c]  ->
DM_lald_D[c] lald_D[c]  ->
DM_12ppd_S[c] 12ppd_S[c]  ->
DM_lald_L[c] lald_L[c]  ->
DM_etoh[c] etoh[c]  ->
DM_id3acald[c] id3acald[c]  ->
DM_ind3ac[c] ind3ac[c]  ->
DM_id3acald[m] id3acald[m]  ->
DM_ind3ac[m] ind3ac[m]  ->
DM_pristanal[c] pristanal[c]  ->
DM_prist[c] prist[c]  ->
DM_aldstrn[c] aldstrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_aldstrn[e]

DM_aldstrn[m] aldstrn[m]  ->
DM_dhap[c] dhap[c]  ->
DM_arachd[c] arachd[c]  ->
DM_12HPET[c] 12HPET[c]  ->
DM_15HPET[c] 15HPET[c]  ->
Warning: Model already has the same reaction you tried to add: sink_5hpet[c]

DM_leuktrA4[c] leuktrA4[c]  ->
DM_dhcholestancoa[x] dhcholestancoa[x]  ->
DM_h2o[r] h2o[r]  ->
DM_o2[r] o2[r]  ->
DM_dhcholestancoa[r] dhcholestancoa[r]  ->
DM_cholcoar[x] cholcoar[x]  ->
DM_cholcoar[r] cholcoar[r]  ->
DM_amuco[c] amuco[c]  ->
DM_amet[r] amet[r]  ->
DM_amet[m] amet[m]  ->
DM_ahcys[m] ahcys[m]  ->
DM_imp[c] imp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_cgly[e]

DM_amp[x] amp[x]  ->
DM_amp[r] amp[r]  ->
Warning: Model already has the same reaction you tried to add: EX_strch1[e]
Warning: Model already has the same reaction you tried to add: EX_glc_D[e]
Warning: Model already has the same reaction you tried to add: EX_strch2[e]
Warning: Model already has the same reaction you tried to add: EX_glygn2[e]
Warning: Model already has the same reaction you tried to add: EX_glygn4[e]

DM_andrstrnglc[c] andrstrnglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_andrstrnglc[e]

DM_andrstrnglc[r] andrstrnglc[r]  ->
Warning: Model already has the same reaction you tried to add: EX_andrstrn[e]

DM_andrstrn[c] andrstrn[c]  ->
DM_andrstrn[r] andrstrn[r]  ->
Warning: Model already has the same reaction you tried to add: EX_antipyrene[e]

DM_antipyrene[c] antipyrene[c]  ->
DM_2aobut[m] 2aobut[m]  ->
DM_msa[m] msa[m]  ->
DM_ala_B[m] ala_B[m]  ->
Warning: Model already has the same reaction you tried to add: EX_apnnox[e]

DM_apnnox[c] apnnox[c]  ->
DM_apoC[c] apoC[c]  ->
Warning: Model already has the same reaction you tried to add: sink_lys_L[c]

DM_apoC_Lys[c] apoC_Lys[c]  ->
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DM_apoC[m] apoC[m]  ->
DM_lys_L[m] lys_L[m]  ->
DM_apoC_Lys[m] apoC_Lys[m]  ->
DM_apoC_Lys_btn[c] apoC_Lys_btn[c]  ->
DM_biocyt[c] biocyt[c]  ->
DM_apoC_Lys_btn[m] apoC_Lys_btn[m]  ->
DM_biocyt[m] biocyt[m]  ->
Warning: Model already has the same reaction you tried to add: EX_appnn[e]

DM_appnn[c] appnn[c]  ->
DM_aprut[c] aprut[c]  ->
DM_n4abutn[c] n4abutn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_aqcobal[e]

DM_aqcobal[c] aqcobal[c]  ->
Warning: Model already has the same reaction you tried to add: EX_arab_L[e]

DM_arab_L[c] arab_L[c]  ->
DM_arachcoa[c] arachcoa[c]  ->
DM_arachcoa[x] arachcoa[x]  ->
DM_arachcrn[c] arachcrn[c]  ->
DM_arachcoa[m] arachcoa[m]  ->
DM_arachcrn[m] arachcrn[m]  ->
DM_arachdcoa[c] arachdcoa[c]  ->
DM_arachdcoa[x] arachdcoa[x]  ->
Warning: Model already has the same reaction you tried to add: EX_arachd[e]

DM_arachd[r] arachd[r]  ->
Warning: Model already has the same reaction you tried to add: EX_arach[e]

DM_arach[c] arach[c]  ->
DM_arg_L[m] arg_L[m]  ->
Warning: Model already has the same reaction you tried to add: EX_lys_L[e]
Warning: Model already has the same reaction you tried to add: EX_arg_L[e]
Warning: Model already has the same reaction you tried to add: sink_arg_L[c]

DM_orn[m] orn[m]  ->
DM_argsuc[c] argsuc[c]  ->
Warning: Model already has the same reaction you tried to add: sink_citr[c]

DM_sgalside_hs[l] sgalside_hs[l]  ->
DM_galside_hs[l] galside_hs[l]  ->
DM_so4[l] so4[l]  ->
DM_Rtotal[c] Rtotal[c]  ->
DM_Rtotalcoa[c] Rtotalcoa[c]  ->
DM_Rtotal3coa[c] Rtotal3coa[c]  ->
DM_Rtotal3[c] Rtotal3[c]  ->
Warning: Model already has the same reaction you tried to add: sink_pmtcoa[c]

DM_hdcoa[c] hdcoa[c]  ->
DM_tdcoa[c] tdcoa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_lnlncacoa[c]

DM_R2coa_hs[c] R2coa_hs[c]  ->
Warning: Model already has the same reaction you tried to add: sink_lnlncgcoa[c]

DM_strdnccoa[c] strdnccoa[c]  ->
DM_dlnlcgcoa[c] dlnlcgcoa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tmndnccoa[c]
Warning: Model already has the same reaction you tried to add: sink_lnlccoa[c]

DM_clpndcoa[c] clpndcoa[c]  ->
DM_dcsptn1coa[c] dcsptn1coa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_c226coa[c]
Warning: Model already has the same reaction you tried to add: sink_stcoa[c]
Warning: Model already has the same reaction you tried to add: sink_odecoa[c]

DM_octd11ecoa[c] octd11ecoa[c]  ->
DM_lneldccoa[c] lneldccoa[c]  ->
DM_nrvnccoa[c] nrvnccoa[c]  ->
DM_od2coa[c] od2coa[c]  ->
DM_ttccoa[c] ttccoa[c]  ->
DM_hexccoa[c] hexccoa[c]  ->
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DM_eicostetcoa[c] eicostetcoa[c]  ->
DM_tetpent6coa[c] tetpent6coa[c]  ->
DM_tetpent3coa[c] tetpent3coa[c]  ->
DM_tettet6coa[c] tettet6coa[c]  ->
DM_tethex3coa[c] tethex3coa[c]  ->
DM_hdd2coa[c] hdd2coa[c]  ->
DM_pmtcoa[m] pmtcoa[m]  ->
DM_Rtotal3coa[m] Rtotal3coa[m]  ->
DM_Rtotal[l] Rtotal[l]  ->
DM_crm_hs[l] crm_hs[l]  ->
DM_sphings[l] sphings[l]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_ascb_L[c] ascb_L[c]  ->
DM_o2s[c] o2s[c]  ->
DM_dhdascb[c] dhdascb[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ascb_L[e]

DM_nh4[m] nh4[m]  ->
DM_asn_L[m] asn_L[m]  ->
Warning: Model already has the same reaction you tried to add: DM_Asn_X_Ser_Thr_ly_

DM_cbp[c] cbp[c]  ->
DM_cbasp[c] cbasp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_asp_D[e]

DM_asp_D[c] asp_D[c]  ->
Warning: Model already has the same reaction you tried to add: DM_K_c_
Warning: Model already has the same reaction you tried to add: EX_k[e]

DM_asp_D[x] asp_D[x]  ->
DM_Nacasp[m] Nacasp[m]  ->
Warning: Model already has the same reaction you tried to add: EX_asp_L[e]

DM_oaa[m] oaa[m]  ->
DM_atp[r] atp[r]  ->
DM_adp[r] adp[r]  ->
Warning: Model already has the same reaction you tried to add: EX_atp[e]
Warning: Model already has the same reaction you tried to add: EX_pi[e]
Warning: Model already has the same reaction you tried to add: EX_amp[e]
Warning: Model already has the same reaction you tried to add: EX_adp[e]

DM_atp[n] atp[n]  ->
DM_atp[x] atp[x]  ->
Warning: Model already has the same reaction you tried to add: EX_avite2[e]
Warning: Model already has the same reaction you tried to add: DM_avite2_c_

DM_gbside_hs[g] gbside_hs[g]  ->
DM_ga2_hs[g] ga2_hs[g]  ->
DM_ga1_hs[g] ga1_hs[g]  ->
DM_gm2_hs[g] gm2_hs[g]  ->
DM_gm1_hs[g] gm1_hs[g]  ->
DM_gd2_hs[g] gd2_hs[g]  ->
DM_gd1b_hs[g] gd1b_hs[g]  ->
DM_gt2_hs[g] gt2_hs[g]  ->
DM_gt1c_hs[g] gt1c_hs[g]  ->
DM_galgbside_hs[g] galgbside_hs[g]  ->
DM_acglcgalgluside_hs[g] acglcgalgluside_hs[g]  ->
DM_galacglcgalgluside_hs[g] galacglcgalgluside_hs[g]  ->
DM_gal14acglcgalgluside_hs[g] gal14acglcgalgluside_hs[g]  ->
DM_acglcgal14acglcgalgluside_hs[g] acglcgal14acglcgalgluside_hs[g]  ->
DM_galacglcgal14acglcgalgluside_hs[g] galacglcgal14acglcgalgluside_hs[g]  ->
DM_acglc13galacglcgal14acglcgalgluside_hs[g] acglc13galacglcgal14acglcgalgluside_hs[g]  ->
DM_galacgalfuc12gal14acglcgalgluside_hs[g] galacgalfuc12gal14acglcgalgluside_hs[g]  ->
DM_galacgalfucgalacglcgal14acglcgalgluside_hs[g] galacgalfucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_acglcgalacglcgal14acglcgalgluside_hs[g] acglcgalacglcgal14acglcgalgluside_hs[g]  ->
DM_galacglcgalacglcgal14acglcgalgluside_hs[g] galacglcgalacglcgal14acglcgalgluside_hs[g]  ->
DM_galacglc13galacglcgal14acglcgalgluside_hs[g] galacglc13galacglcgal14acglcgalgluside_hs[g]  ->
DM_galthcrm_hs[g] galthcrm_hs[g]  ->
DM_galgalthcrm_hs[g] galgalthcrm_hs[g]  ->
DM_galgalgalthcrm_hs[g] galgalgalthcrm_hs[g]  ->
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DM_acglcgalgbside_hs[g] acglcgalgbside_hs[g]  ->
DM_galacglcgalgbside_hs[g] galacglcgalgbside_hs[g]  ->
DM_h2o[g] h2o[g]  ->
DM_gm2a_hs[g] gm2a_hs[g]  ->
DM_gm1a_hs[g] gm1a_hs[g]  ->
DM_gluside_hs[g] gluside_hs[g]  ->
DM_cholcoa[x] cholcoa[x]  ->
DM_gchola[x] gchola[x]  ->
DM_taur[x] taur[x]  ->
DM_tchola[x] tchola[x]  ->
DM_dgcholcoa[x] dgcholcoa[x]  ->
DM_dgchol[x] dgchol[x]  ->
DM_dcholcoa[x] dcholcoa[x]  ->
Warning: Model already has the same reaction you tried to add: sink_btn[c]

DM_btamp[c] btamp[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_btn[m] btn[m]  ->
DM_btamp[m] btamp[m]  ->
DM_ala_B[c] ala_B[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ala_B[e]

DM_4tmeabutn[c] 4tmeabutn[c]  ->
DM_succ[c] succ[c]  ->
DM_caro[c] caro[c]  ->
DM_retinal[c] retinal[c]  ->
DM_glc_D[c] glc_D[c]  ->
DM_bhb[m] bhb[m]  ->
DM_gdpmann[c] gdpmann[c]  ->
DM_betald[m] betald[m]  ->
DM_glyb[m] glyb[m]  ->
Warning: Model already has the same reaction you tried to add: EX_bhb[e]

DM_bhb[c] bhb[c]  ->
DM_hcys_L[c] hcys_L[c]  ->
DM_glyb[c] glyb[c]  ->
DM_dmgly[c] dmgly[c]  ->
Warning: Model already has the same reaction you tried to add: sink_met_L[c]
Warning: Model already has the same reaction you tried to add: EX_bildglcur[e]

DM_bildglcur[c] bildglcur[c]  ->
DM_bildglcur[r] bildglcur[r]  ->
Warning: Model already has the same reaction you tried to add: EX_bilglcur[e]

DM_bilglcur[c] bilglcur[c]  ->
DM_bilglcur[r] bilglcur[r]  ->
DM_biliverd[c] biliverd[c]  ->
DM_bilirub[c] bilirub[c]  ->
Warning: Model already has the same reaction you tried to add: EX_bilirub[e]

DM_bilirub[r] bilirub[r]  ->
DM_biocyt[n] biocyt[n]  ->
DM_h[r] h[r]  ->
DM_memgacpail_hs[r] memgacpail_hs[r]  ->
DM_dolp_L[r] dolp_L[r]  ->
DM_m2emgacpail_hs[r] m2emgacpail_hs[r]  ->
DM_dolmanp_U[r] dolmanp_U[r]  ->
DM_dolp_U[r] dolp_U[r]  ->
DM_h2o[n] h2o[n]  ->
DM_lys_L[n] lys_L[n]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_btn[n] btn[n]  ->
Warning: Model already has the same reaction you tried to add: EX_biocyt[e]
Warning: Model already has the same reaction you tried to add: EX_btn[e]

DM_3uib[c] 3uib[c]  ->
DM_3aib_D[c] 3aib_D[c]  ->
DM_but[c] but[c]  ->
DM_but[m] but[m]  ->
Warning: Model already has the same reaction you tried to add: EX_bvite[e]
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Warning: Model already has the same reaction you tried to add: DM_bvite_c_
Warning: Model already has the same reaction you tried to add: EX_bz[e]
DM_bz[c] bz[c]  ->
DM_bz[r] bz[r]  ->
DM_nadph[r] nadph[r]  ->
DM_nadp[r] nadp[r]  ->
DM_44mctr[r] 44mctr[r]  ->
DM_44mzym[r] 44mzym[r]  ->
DM_pmtcrn[c] pmtcrn[c]  ->
DM_pmtcrn[m] pmtcrn[m]  ->
DM_hdcecrn[c] hdcecrn[c]  ->
DM_hdd2crn[c] hdd2crn[c]  ->
DM_hdcoa[m] hdcoa[m]  ->
DM_hdcecrn[m] hdcecrn[m]  ->
DM_hdd2coa[m] hdd2coa[m]  ->
DM_hdd2crn[m] hdd2crn[m]  ->
DM_stcrn[c] stcrn[c]  ->
DM_stcoa[m] stcoa[m]  ->
DM_stcrn[m] stcrn[m]  ->
DM_odecrn[c] odecrn[c]  ->
DM_odecoa[m] odecoa[m]  ->
DM_odecrn[m] odecrn[m]  ->
DM_arachdcrn[c] arachdcrn[c]  ->
DM_arachdcoa[m] arachdcoa[m]  ->
DM_arachdcrn[m] arachdcrn[m]  ->
DM_c226coa[x] c226coa[x]  ->
DM_c226crn[c] c226crn[c]  ->
DM_c226coa[m] c226coa[m]  ->
DM_c226crn[m] c226crn[m]  ->
DM_co2[r] co2[r]  ->
DM_4mzym_int1[r] 4mzym_int1[r]  ->
DM_4mzym_int2[r] 4mzym_int2[r]  ->
DM_nadh[r] nadh[r]  ->
DM_nad[r] nad[r]  ->
DM_zym_int2[r] zym_int2[r]  ->
DM_zymst[r] zymst[r]  ->
DM_ca2[c] ca2[c]  ->
DM_ca2[e] ca2[e]  ->
Warning: Model already has the same reaction you tried to add: EX_caro[e]
Warning: Model already has the same reaction you tried to add: EX_carveol[e]
DM_carveol[c] carveol[c]  ->
DM_etoh[x] etoh[x]  ->
DM_h2o2[m] h2o2[m]  ->
DM_cbl2[c] cbl2[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_cbl2[m] cbl2[m]  ->
DM_nh4[r] nh4[r]  ->
DM_glc_D[r] glc_D[r]  ->
DM_cbp[r] cbp[r]  ->
DM_g6p[r] g6p[r]  ->
DM_cbp[m] cbp[m]  ->
DM_pi[r] pi[r]  ->
DM_ppi[r] ppi[r]  ->
DM_prostge1[c] prostge1[c]  ->
DM_prostge2[c] prostge2[c]  ->
DM_prostgf2[c] prostgf2[c]  ->
DM_cdpdag_hs[c] cdpdag_hs[c]  ->
DM_inost[c] inost[c]  ->
DM_pail_hs[c] pail_hs[c]  ->
DM_cdpdag_hs[m] cdpdag_hs[m]  ->
DM_ctp[c] ctp[c]  ->
DM_pa_hs[m] pa_hs[m]  ->
DM_ctp[m] ctp[m]  ->
DM_dag_hs[c] dag_hs[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
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DM_pchol_hs[c] pchol_hs[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_pe_hs[c] pe_hs[c]  ->
DM_crm_hs[c] crm_hs[c]  ->
DM_crmp_hs[c] crmp_hs[c]  ->
DM_crm_hs[g] crm_hs[g]  ->
DM_crm_hs[r] crm_hs[r]  ->
DM_gluside_hs[c] gluside_hs[c]  ->
DM_gluside_hs[r] gluside_hs[r]  ->
DM_cgly[c] cgly[c]  ->
DM_chsterol[r] chsterol[r]  ->
DM_xol25oh[r] xol25oh[r]  ->
Warning: Model already has the same reaction you tried to add: sink_chol[c]

DM_coa[n] coa[n]  ->
DM_chol[n] chol[n]  ->
DM_cholp[c] cholp[c]  ->
DM_chol[m] chol[m]  ->
Warning: Model already has the same reaction you tried to add: EX_cholate[e]
Warning: Model already has the same reaction you tried to add: sink_cholate[c]

DM_cholp[g] cholp[g]  ->
DM_cholp[l] cholp[l]  ->
DM_chol[g] chol[g]  ->
DM_chol[r] chol[r]  ->
DM_chsterol[c] chsterol[c]  ->
DM_chsterols[c] chsterols[c]  ->
DM_chsterol[l] chsterol[l]  ->
DM_chsterol[m] chsterol[m]  ->
DM_chsterol[g] chsterol[g]  ->
DM_chtn[c] chtn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acgam[e]
Warning: Model already has the same reaction you tried to add: EX_chtn[e]

DM_itaccoa[m] itaccoa[m]  ->
DM_citmcoa_L[m] citmcoa_L[m]  ->
DM_citr_L[m] citr_L[m]  ->
Warning: Model already has the same reaction you tried to add: EX_cit[e]

DM_pep[m] pep[m]  ->
DM_creat[m] creat[m]  ->
DM_pcreat[m] pcreat[m]  ->
DM_creat[c] creat[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_pcreat[c] pcreat[c]  ->
DM_cl[e] cl[e]  ->
DM_cl[c] cl[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_for[c] for[c]  ->
Warning: Model already has the same reaction you tried to add: EX_for[e]

DM_i[c] i[c]  ->
Warning: Model already has the same reaction you tried to add: EX_i[e]

DM_oxa[c] oxa[c]  ->
Warning: Model already has the same reaction you tried to add: EX_oxa[e]

DM_clpndcoa[x] clpndcoa[x]  ->
DM_clpndcrn[c] clpndcrn[c]  ->
DM_clpndcoa[m] clpndcoa[m]  ->
DM_clpndcrn[m] clpndcrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_clpnd[e]

DM_clpnd[c] clpnd[c]  ->
DM_pglyc_hs[c] pglyc_hs[c]  ->
DM_clpn_hs[c] clpn_hs[c]  ->
DM_cmp[g] cmp[g]  ->
DM_cmpacna[c] cmpacna[c]  ->
DM_cmpacna[g] cmpacna[g]  ->
DM_cmpacna[n] cmpacna[n]  ->
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DM_ppi[n] ppi[n]  ->
DM_ctp[n] ctp[n]  ->
DM_co2[g] co2[g]  ->
DM_co2[x] co2[x]  ->
DM_coa[g] coa[g]  ->
DM_coa[l] coa[l]  ->
DM_coa[r] coa[r]  ->
DM_coke[r] coke[r]  ->
DM_egme[r] egme[r]  ->
DM_2dpmhobq[m] 2dpmhobq[m]  ->
DM_q10[m] q10[m]  ->
DM_2dp6mobq[m] 2dp6mobq[m]  ->
DM_2dp6mobq_me[m] 2dp6mobq_me[m]  ->
DM_2dp6mep[m] 2dp6mep[m]  ->
DM_Tn_antigen[g] Tn_antigen[g]  ->
DM_core3[g] core3[g]  ->
DM_core4[g] core4[g]  ->
Warning: Model already has the same reaction you tried to add: DM_core5_g_
DM_core6[g] core6[g]  ->
Warning: Model already has the same reaction you tried to add: DM_core7_g_
Warning: Model already has the same reaction you tried to add: DM_core8_g_
DM_co[c] co[c]  ->
Warning: Model already has the same reaction you tried to add: EX_co[e]
DM_T4hcinnm[m] T4hcinnm[m]  ->
Warning: Model already has the same reaction you tried to add: EX_coumarin[e]
DM_coumarin[c] coumarin[c]  ->
Warning: Model already has the same reaction you tried to add: EX_creat[e]
Warning: Model already has the same reaction you tried to add: EX_crmp_hs[e]
DM_crn[x] crn[x]  ->
DM_pcrn[x] pcrn[x]  ->
DM_pcrn[c] pcrn[c]  ->
DM_acrn[x] acrn[x]  ->
Warning: Model already has the same reaction you tried to add: EX_crn[e]
DM_dmnoncrn[x] dmnoncrn[x]  ->
DM_dmnoncrn[m] dmnoncrn[m]  ->
DM_crtn[c] crtn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_crtsl[e]
DM_crtsl[c] crtsl[c]  ->
DM_crtsl[m] crtsl[m]  ->
DM_crtsl[r] crtsl[r]  ->
Warning: Model already has the same reaction you tried to add: EX_crtstrn[e]
DM_crtstrn[c] crtstrn[c]  ->
DM_crtstrn[m] crtstrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_crvnc[e]
Warning: Model already has the same reaction you tried to add: sink_crvnc[c]
DM_cspg_a[l] cspg_a[l]  ->
Warning: Model already has the same reaction you tried to add: DM_Ser_Gly_Ala_X_Gly_ly_
DM_cs_a[l] cs_a[l]  ->
DM_cspg_b[l] cspg_b[l]  ->
DM_cs_b[l] cs_b[l]  ->
DM_cspg_c[l] cspg_c[l]  ->
DM_cs_c[l] cs_c[l]  ->
DM_cspg_d[l] cspg_d[l]  ->
DM_cs_d[l] cs_d[l]  ->
DM_cspg_e[l] cspg_e[l]  ->
DM_cs_e[l] cs_e[l]  ->
DM_pcrn[m] pcrn[m]  ->
DM_dmnoncoa[x] dmnoncoa[x]  ->
DM_ppcoa[x] ppcoa[x]  ->
DM_acrn[r] acrn[r]  ->
DM_crn[r] crn[r]  ->
Warning: Model already has the same reaction you tried to add: EX_csn[e]
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DM_csn[c] csn[c]  ->
DM_cspg_a[g] cspg_a[g]  ->
Warning: Model already has the same reaction you tried to add: EX_cspg_a[e]

DM_cspg_b[g] cspg_b[g]  ->
Warning: Model already has the same reaction you tried to add: EX_cspg_b[e]

DM_cspg_c[g] cspg_c[g]  ->
Warning: Model already has the same reaction you tried to add: EX_cspg_c[e]

DM_cspg_d[g] cspg_d[g]  ->
Warning: Model already has the same reaction you tried to add: EX_cspg_d[e]

DM_cspg_e[g] cspg_e[g]  ->
Warning: Model already has the same reaction you tried to add: EX_cspg_e[e]
Warning: Model already has the same reaction you tried to add: EX_cyan[e]

DM_cyan[c] cyan[c]  ->
DM_cyan[m] cyan[m]  ->
DM_focytC[m] focytC[m]  ->
DM_ficytC[m] ficytC[m]  ->
DM_q10h2[m] q10h2[m]  ->
Warning: Model already has the same reaction you tried to add: DM_Lcystin

DM_gthrd[c] gthrd[c]  ->
DM_gthox[c] gthox[c]  ->
DM_mercppyr[c] mercppyr[c]  ->
DM_cys_L[m] cys_L[m]  ->
Warning: Model already has the same reaction you tried to add: EX_glu_L[e]
Warning: Model already has the same reaction you tried to add: EX_Lcystin[e]

DM_cytd[c] cytd[c]  ->
DM_uri[c] uri[c]  ->
DM_cmp[m] cmp[m]  ->
DM_cytd[m] cytd[m]  ->
DM_nh4[n] nh4[n]  ->
DM_h[n] h[n]  ->
DM_cytd[n] cytd[n]  ->
DM_uri[n] uri[n]  ->
Warning: Model already has the same reaction you tried to add: EX_cytd[e]

DM_cytd[l] cytd[l]  ->
DM_cdp[c] cdp[c]  ->
DM_dgtp[c] dgtp[c]  ->
DM_dgdp[c] dgdp[c]  ->
DM_cmp[n] cmp[n]  ->
DM_cdp[n] cdp[n]  ->
Warning: Model already has the same reaction you tried to add: DM_dgtp_n_

DM_dgdp[n] dgdp[n]  ->
DM_dcmp[c] dcmp[c]  ->
DM_dcdp[c] dcdp[c]  ->
DM_dcmp[n] dcmp[n]  ->
DM_dcdp[n] dcdp[n]  ->
DM_dctp[c] dctp[c]  ->
Warning: Model already has the same reaction you tried to add: DM_dctp_n_
Warning: Model already has the same reaction you tried to add: DM_datp_n_

DM_dadp[n] dadp[n]  ->
DM_utp[c] utp[c]  ->
DM_udp[n] udp[n]  ->
DM_utp[n] utp[n]  ->
DM_cdp[m] cdp[m]  ->
DM_adp[n] adp[n]  ->
DM_gtp[n] gtp[n]  ->
DM_gdp[n] gdp[n]  ->
Warning: Model already has the same reaction you tried to add: EX_3aib_D[e]

DM_3aib_D[m] 3aib_D[m]  ->
DM_dad_2[c] dad_2[c]  ->
DM_din[c] din[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dad_2[e]
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Warning: Model already has the same reaction you tried to add: EX_din[e]

DM_dag_hs[r] dag_hs[r]  ->
DM_pa_hs[n] pa_hs[n]  ->
DM_dag_hs[n] dag_hs[n]  ->
Warning: Model already has the same reaction you tried to add: EX_dag_hs[e]

DM_nh4[x] nh4[x]  ->
DM_ala_D[x] ala_D[x]  ->
DM_arg_D[x] arg_D[x]  ->
DM_5g2oxpt[x] 5g2oxpt[x]  ->
DM_23doguln[c] 23doguln[c]  ->
DM_oaa[x] oaa[x]  ->
DM_dd2coa[m] dd2coa[m]  ->
DM_dd3coa[m] dd3coa[m]  ->
DM_dcmp[m] dcmp[m]  ->
DM_dcyt[m] dcyt[m]  ->
DM_dcyt[n] dcyt[n]  ->
DM_dcsptn1coa[x] dcsptn1coa[x]  ->
DM_dcsptn1crn[c] dcsptn1crn[c]  ->
DM_dcsptn1coa[m] dcsptn1coa[m]  ->
DM_dcsptn1crn[m] dcsptn1crn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_dcsptn1[e]

DM_dcsptn1[c] dcsptn1[c]  ->
DM_L_dpchrm[c] L_dpchrm[c]  ->
DM_56dihindlcrbxlt[c] 56dihindlcrbxlt[c]  ->
DM_dcyt[c] dcyt[c]  ->
DM_duri[c] duri[c]  ->
DM_duri[n] duri[n]  ->
Warning: Model already has the same reaction you tried to add: EX_dcyt[e]

DM_4h2oglt[m] 4h2oglt[m]  ->
Warning: Model already has the same reaction you tried to add: EX_debrisoquine[e]

DM_debrisoquine[c] debrisoquine[c]  ->
DM_decdp[c] decdp[c]  ->
DM_decdp[m] decdp[m]  ->
DM_dedoldp_L[c] dedoldp_L[c]  ->
DM_dedolp_L[c] dedolp_L[c]  ->
DM_dedol_L[c] dedol_L[c]  ->
DM_dolichol_L[c] dolichol_L[c]  ->
DM_dolichol_U[c] dolichol_U[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tag_hs[c]
Warning: Model already has the same reaction you tried to add: EX_dgchol[e]
Warning: Model already has the same reaction you tried to add: sink_dgchol[c]
Warning: Model already has the same reaction you tried to add: DM_datp_m_

DM_dadp[m] dadp[m]  ->
DM_dgdp[m] dgdp[m]  ->
DM_dgmp[m] dgmp[m]  ->
DM_dgsn[m] dgsn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_dgsn[e]

DM_dgsn[c] dgsn[c]  ->
DM_3dhguln[c] 3dhguln[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dhdascb[e]

DM_dhap[x] dhap[x]  ->
DM_dhcholestanate[m] dhcholestanate[m]  ->
DM_dhcholestanate[x] dhcholestanate[x]  ->
DM_fad[r] fad[r]  ->
DM_fadh2[r] fadh2[r]  ->
DM_zymstnl[r] zymstnl[r]  ->
DM_chlstol[r] chlstol[r]  ->
DM_lthstrl[r] lthstrl[r]  ->
DM_dsmsterol[r] dsmsterol[r]  ->
DM_ddsmsterol[r] ddsmsterol[r]  ->
DM_dhcrm_hs[c] dhcrm_hs[c]  ->
Warning: Model already has the same reaction you tried to add: sink_fad[c]

DM_fadh2[c] fadh2[c]  ->
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DM_3dpdhb_me[m] 3dpdhb_me[m]  ->
Warning: Model already has the same reaction you tried to add: EX_dheas[e]
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DM_dheas[c] dheas[c]  ->
DM_dheas[r] dheas[r]  ->
DM_dhea[c] dhea[c]  ->
DM_dhea[r] dhea[r]  ->
DM_dhf[c] dhf[c]  ->
DM_dhf[l] dhf[l]  ->
DM_dhf[m] dhf[m]  ->
DM_dhor_S[c] dhor_S[c]  ->
DM_orot[c] orot[c]  ->
DM_56dura[c] 56dura[c]  ->
DM_cala[c] cala[c]  ->
DM_56dthm[c] 56dthm[c]  ->
DM_dhbpt[c] dhbpt[c]  ->
DM_thbpt[c] thbpt[c]  ->
DM_mlthf[c] mlthf[c]  ->
DM_didp[c] didp[c]  ->
DM_didp[n] didp[n]  ->
DM_digalsgalside_hs[c] digalsgalside_hs[c]  ->
DM_digalsgalside_hs[g] digalsgalside_hs[g]  ->
DM_digalside_hs[c] digalside_hs[c]  ->
DM_digalside_hs[g] digalside_hs[g]  ->
DM_digalside_hs[l] digalside_hs[l]  ->
DM_ditp[c] ditp[c]  ->
DM_ditp[n] ditp[n]  ->
DM_dkmpp[c] dkmpp[c]  ->
DM_2kmb[c] 2kmb[c]  ->
Warning: Model already has the same reaction you tried to add: EX_lac_D[e]
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DM_lac_D[c] lac_D[c]  ->
DM_lac_D[m] lac_D[m]  ->
DM_dlnlcgcrn[c] dlnlcgcrn[c]  ->
DM_dlnlcgcoa[m] dlnlcgcoa[m]  ->
DM_dlnlcgcrn[m] dlnlcgcrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_dlnlcg[e]
```

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DM_dlnlcg[c] dlnlcg[c]  ->
Warning: Model already has the same reaction you tried to add: DM_13_cis_oretn_n_
Warning: Model already has the same reaction you tried to add: DM_13_cis_retn_n_
Warning: Model already has the same reaction you tried to add: DM_dctp_m_
Warning: Model already has the same reaction you tried to add: DM_dem2emgacpail_prot_hs_r_
Warning: Model already has the same reaction you tried to add: DM_dgpi_prot_hs_r_
Warning: Model already has the same reaction you tried to add: DM_dgtp_m_
Warning: Model already has the same reaction you tried to add: DM_dsT_antigen_g_
Warning: Model already has the same reaction you tried to add: DM_dttp_m_
Warning: Model already has the same reaction you tried to add: DM_dttp_n_
Warning: Model already has the same reaction you tried to add: DM_ethamp_r_
Warning: Model already has the same reaction you tried to add: DM_gpi_sig_er_
Warning: Model already has the same reaction you tried to add: DM_hretn_n_
Warning: Model already has the same reaction you tried to add: DM_kdn_c_
Warning: Model already has the same reaction you tried to add: DM_m_em_3gacpail_prot_hs_r_
Warning: Model already has the same reaction you tried to add: DM_melanin_c_
Warning: Model already has the same reaction you tried to add: DM_mem2emgacpail_prot_hs_r_
Warning: Model already has the same reaction you tried to add: DM_n5m2masn_g_
Warning: Model already has the same reaction you tried to add: DM_oretn_n_
Warning: Model already has the same reaction you tried to add: DM_Ser_Thr_ly_
Warning: Model already has the same reaction you tried to add: DM_sprm_c_
Warning: Model already has the same reaction you tried to add: DM_sTn_antigen_g_
Warning: Model already has the same reaction you tried to add: DM_yvite_c_
Warning: Model already has the same reaction you tried to add: EX_dmantipyrine[e]
```

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DM_dmantipyrine[c] dmantipyrine[c]  ->
DM_ppi[x] ppi[x]  ->
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DM_dmpp[x] dmpp[x]  ->
DM_ipdp[x] ipdp[x]  ->
DM_grdp[x] grdp[x]  ->
DM_fald[m] fald[m]  ->
DM_dmgly[m] dmgly[m]  ->
DM_sarcs[m] sarcs[m]  ->
DM_dmhptcrn[c] dmhptcrn[c]  ->
DM_dmhptcoa[m] dmhptcoa[m]  ->
DM_dmhptcrn[m] dmhptcrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_dmhptcrn[e]
DM_dmnoncrn[c] dmnoncrn[c]  ->
DM_dmnoncoa[c] dmnoncoa[c]  ->
DM_dmnoncoa[m] dmnoncoa[m]  ->
DM_dnad[c] dnad[c]  ->
DM_dnad[n] dnad[n]  ->
DM_dcdp[m] dcdp[m]  ->
DM_dtdp[m] dtdp[m]  ->
DM_dtdp[c] dtdp[c]  ->
DM_dudp[c] dudp[c]  ->
DM_dudp[m] dudp[m]  ->
DM_dutp[c] dutp[c]  ->
DM_dutp[m] dutp[m]  ->
DM_dttp[c] dttp[c]  ->
DM_thrnt[c] thrnt[c]  ->
DM_dolglcp_L[c] dolglcp_L[c]  ->
DM_dolglcp_L[r] dolglcp_L[r]  ->
DM_dolichol_L[r] dolichol_L[r]  ->
DM_dolichol_U[r] dolichol_U[r]  ->
DM_dolp_L[c] dolp_L[c]  ->
DM_dolp_U[c] dolp_U[c]  ->
DM_dolmanp_U[c] dolmanp_U[c]  ->
DM_2c23dh56dhoxin[c] 2c23dh56dhoxin[c]  ->
DM_dopaqn[c] dopaqn[c]  ->
DM_dopasf[c] dopasf[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dopasf[e]
Warning: Model already has the same reaction you tried to add: EX_dopa[e]
DM_orn_D[x] orn_D[x]  ->
DM_5a2opntn[x] 5a2opntn[x]  ->
DM_dpcoa[l] dpcoa[l]  ->
DM_dpcoa[c] dpcoa[c]  ->
DM_3pg[c] 3pg[c]  ->
DM_23dpg[c] 23dpg[c]  ->
DM_13dpg[c] 13dpg[c]  ->
DM_pi[x] pi[x]  ->
DM_5dpmev[x] 5dpmev[x]  ->
DM_ipdp[c] ipdp[c]  ->
DM_frdp[c] frdp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_drib[e]
DM_2dr5p[c] 2dr5p[c]  ->
DM_g3p[c] g3p[c]  ->
DM_dtdp[n] dtdp[n]  ->
DM_dudp[n] dudp[n]  ->
DM_dump[c] dump[c]  ->
DM_dump[n] dump[n]  ->
DM_ura[c] ura[c]  ->
DM_thym[c] thym[c]  ->
DM_dump[m] dump[m]  ->
DM_duri[m] duri[m]  ->
Warning: Model already has the same reaction you tried to add: EX_duri[e]
DM_dutp[n] dutp[n]  ->
Warning: Model already has the same reaction you tried to add: EX_eaflatoxin[e]
DM_eaflatoxin[c] eaflatoxin[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ebastineoh[e]
DM_ebastineoh[c] ebastineoh[c]  ->
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DM_ebastineoh[r] ebastineoh[r]  ->
Warning: Model already has the same reaction you tried to add: EX_ebastine[e]

DM_ebastine[c] ebastine[c]  ->
DM_ebastine[r] ebastine[r]  ->
DM_3hbcoa[m] 3hbcoa[m]  ->
DM_b2coa[x] b2coa[x]  ->
DM_3hbcoa[x] 3hbcoa[x]  ->
DM_3hmbcoa[m] 3hmbcoa[m]  ->
DM_eicostetcrn[c] eicostetcrn[c]  ->
DM_eicostetcoa[m] eicostetcoa[m]  ->
DM_eicostetcrn[m] eicostetcrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_eicostet[e]

DM_eicostet[c] eicostet[c]  ->
DM_elaidcrn[c] elaidcrn[c]  ->
DM_od2coa[m] od2coa[m]  ->
DM_elaidcrn[m] elaidcrn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_elaid[e]

DM_elaid[c] elaid[c]  ->
DM_s2l2n2m2m[c] s2l2n2m2m[c]  ->
DM_n2m2nm[l] n2m2nm[l]  ->
DM_ksi_deg2[l] ksi_deg2[l]  ->
DM_ksi_deg3[l] ksi_deg3[l]  ->
DM_s2l2n2m2m[l] s2l2n2m2m[l]  ->
DM_s2l2n2m2mn[l] s2l2n2m2mn[l]  ->
Warning: Model already has the same reaction you tried to add: EX_estradiolglc[e]

DM_estradiolglc[c] estradiolglc[c]  ->
DM_estradiolglc[r] estradiolglc[r]  ->
Warning: Model already has the same reaction you tried to add: EX_estradiol[e]

DM_estradiol[c] estradiol[c]  ->
DM_estradiol[r] estradiol[r]  ->
DM_estriolglc[c] estriolglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_estriolglc[e]

DM_estriolglc[r] estriolglc[r]  ->
DM_estriol[r] estriol[r]  ->
DM_estriol[c] estriol[c]  ->
DM_estroneglc[c] estroneglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_estroneglc[e]

DM_estroneglc[r] estroneglc[r]  ->
Warning: Model already has the same reaction you tried to add: EX_estrones[e]

DM_estrones[c] estrones[c]  ->
DM_estrone[r] estrone[r]  ->
DM_estrone[c] estrone[c]  ->
DM_etfox[m] etfox[m]  ->
DM_etfrd[m] etfrd[m]  ->
DM_ethamp[c] ethamp[c]  ->
DM_etha[c] etha[c]  ->
Warning: Model already has the same reaction you tried to add: EX_10fthf[e]
Warning: Model already has the same reaction you tried to add: EX_10fthf5glu[e]
Warning: Model already has the same reaction you tried to add: EX_10fthf6glu[e]
Warning: Model already has the same reaction you tried to add: EX_10fthf7glu[e]
Warning: Model already has the same reaction you tried to add: EX_11_cis_retfa[e]
Warning: Model already has the same reaction you tried to add: EX_13_cis_retnglc[e]
Warning: Model already has the same reaction you tried to add: EX_1glyc_hs[e]
Warning: Model already has the same reaction you tried to add: EX_35cgmp[e]
Warning: Model already has the same reaction you tried to add: EX_3aib[e]
Warning: Model already has the same reaction you tried to add: EX_4hphac[e]
Warning: Model already has the same reaction you tried to add: EX_5dhf[e]
Warning: Model already has the same reaction you tried to add: EX_5thf[e]
Warning: Model already has the same reaction you tried to add: EX_6dhf[e]
Warning: Model already has the same reaction you tried to add: EX_6thf[e]
Warning: Model already has the same reaction you tried to add: EX_7dhf[e]
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Warning: Model already has the same reaction you tried to add: EX_7thf[e]
Warning: Model already has the same reaction you tried to add: EX_9_cis_retfa[e]
Warning: Model already has the same reaction you tried to add: EX_adprbp[e]
Warning: Model already has the same reaction you tried to add: EX_ak2lgchol_hs[e]
Warning: Model already has the same reaction you tried to add: EX_aprgstrn[e]
Warning: Model already has the same reaction you tried to add: EX_avite1[e]
Warning: Model already has the same reaction you tried to add: EX_camp[e]
Warning: Model already has the same reaction you tried to add: EX_chsterol[e]
Warning: Model already has the same reaction you tried to add: EX_cmp[e]
Warning: Model already has the same reaction you tried to add: EX_dhf[e]
Warning: Model already has the same reaction you tried to add: EX_digalsgalside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fuc13galacglcgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fuc14galacglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucacgalfucgalacglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucacngal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucacngalacglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucfuc12gal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucfuc132galacglcgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucfucfucgalacglc13galacglcgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucfucfucgalacglcgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucfucgalacglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_fucgalfucgalacglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add: EX_fucgalgbside_hs[e]
Warning: Model already has the same reaction you tried to add: EX_fuc_L[e]
Warning: Model already has the same reaction you tried to add: EX_galacglcgalgbside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_galfuc12gal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_galfucgalacglcgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add:
EX_galgalfucfucgalacglcgalacglcgal14acglcgalgluside_hs[e]
Warning: Model already has the same reaction you tried to add: EX_galgalgalthcrm_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gbside_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gchola[e]
Warning: Model already has the same reaction you tried to add: EX_gd1b2_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gd1c_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gdp[e]
Warning: Model already has the same reaction you tried to add: EX_gluala[e]
Warning: Model already has the same reaction you tried to add: EX_glyc_S[e]
Warning: Model already has the same reaction you tried to add: EX_glygn5[e]
Warning: Model already has the same reaction you tried to add: EX_gmp[e]
Warning: Model already has the same reaction you tried to add: EX_gp1c_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gp1calpha_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gq1b_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gq1balpha_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gsn[e]

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Warning: Model already has the same reaction you tried to add: EX_gt1a_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gthox[e]
Warning: Model already has the same reaction you tried to add: EX_gthrd[e]
Warning: Model already has the same reaction you tried to add: EX_gtp[e]
Warning: Model already has the same reaction you tried to add: EX_h2o2[e]
Warning: Model already has the same reaction you tried to add: EX_ha[e]
Warning: Model already has the same reaction you tried to add: EX_ha_pre1[e]
Warning: Model already has the same reaction you tried to add: EX_hcoumarin[e]
Warning: Model already has the same reaction you tried to add: EX_hdca[e]
Warning: Model already has the same reaction you tried to add: EX_hdcea[e]
Warning: Model already has the same reaction you tried to add: EX_hestratriol[e]
Warning: Model already has the same reaction you tried to add: EX_hexc[e]
Warning: Model already has the same reaction you tried to add: EX_hista[e]
Warning: Model already has the same reaction you tried to add: EX_hom_L[e]
Warning: Model already has the same reaction you tried to add: EX_hpdca[e]
Warning: Model already has the same reaction you tried to add: EX_hspg[e]
Warning: Model already has the same reaction you tried to add: EX_htaxol[e]
Warning: Model already has the same reaction you tried to add: EX_idp[e]
Warning: Model already has the same reaction you tried to add: EX_imp[e]
Warning: Model already has the same reaction you tried to add: EX_inost[e]
Warning: Model already has the same reaction you tried to add: EX_ksi[e]
Warning: Model already has the same reaction you tried to add: EX_ksi_deg1[e]
Warning: Model already has the same reaction you tried to add: EX_ksii_core2[e]
Warning: Model already has the same reaction you tried to add: EX_ksii_core4[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrA4[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrB4[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrC4[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrD4[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrE4[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrF4[e]
Warning: Model already has the same reaction you tried to add: EX_lgnc[e]
Warning: Model already has the same reaction you tried to add: EX_limnen[e]
Warning: Model already has the same reaction you tried to add: EX_lipoate[e]
Warning: Model already has the same reaction you tried to add: EX_lneldc[e]
Warning: Model already has the same reaction you tried to add: EX_lnlc[e]
Warning: Model already has the same reaction you tried to add: EX_lnlnca[e]
Warning: Model already has the same reaction you tried to add: EX_lnlncg[e]
Warning: Model already has the same reaction you tried to add: EX_lpchol_hs[e]
Warning: Model already has the same reaction you tried to add: EX_mag_hs[e]
Warning: Model already has the same reaction you tried to add: EX_meoh[e]
Warning: Model already has the same reaction you tried to add: EX_mercplaccys[e]
Warning: Model already has the same reaction you tried to add: EX_mthgxl[e]
Warning: Model already has the same reaction you tried to add: EX_n2m2nmasn[e]
Warning: Model already has the same reaction you tried to add: EX_nad[e]
Warning: Model already has the same reaction you tried to add: EX_nadp[e]
Warning: Model already has the same reaction you tried to add: EX_ncam[e]
Warning: Model already has the same reaction you tried to add: EX_nifedipine[e]
Warning: Model already has the same reaction you tried to add: EX_no[e]
Warning: Model already has the same reaction you tried to add: EX_npthl[e]
Warning: Model already has the same reaction you tried to add: EX_nrpphr[e]
Warning: Model already has the same reaction you tried to add: EX_nrpphrsf[e]
Warning: Model already has the same reaction you tried to add: EX_nrvnc[e]
Warning: Model already has the same reaction you tried to add: EX_o2s[e]
Warning: Model already has the same reaction you tried to add: EX_oagd3_hs[e]
Warning: Model already has the same reaction you tried to add: EX_oagt3_hs[e]
Warning: Model already has the same reaction you tried to add: EX_ocdca[e]
Warning: Model already has the same reaction you tried to add: EX_ocdcea[e]
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Warning: Model already has the same reaction you tried to add: EX_octa[e]
Warning: Model already has the same reaction you tried to add: EX_omeprazole[e]
Warning: Model already has the same reaction you tried to add: EX_onpthl[e]
Warning: Model already has the same reaction you tried to add: EX_paf_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pchol_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe_hs[e]
Warning: Model already has the same reaction you tried to add: EX_peplys[e]
Warning: Model already has the same reaction you tried to add: EX_perillyl[e]
Warning: Model already has the same reaction you tried to add: EX_pglyc_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pheacgln[e]
Warning: Model already has the same reaction you tried to add: EX_phyQ[e]
Warning: Model already has the same reaction you tried to add: EX_phyt[e]
Warning: Model already has the same reaction you tried to add: EX_prgstrn[e]
DM_pro_D[e] pro_D[e]  ->
Warning: Model already has the same reaction you tried to add: EX_prostgd2[e]
Warning: Model already has the same reaction you tried to add: EX_prostge1[e]
Warning: Model already has the same reaction you tried to add: EX_prostge2[e]
Warning: Model already has the same reaction you tried to add: EX_prostgf2[e]
Warning: Model already has the same reaction you tried to add: EX_ps_hs[e]
Warning: Model already has the same reaction you tried to add: EX_ptdca[e]
Warning: Model already has the same reaction you tried to add: EX_rbt[e]
Warning: Model already has the same reaction you tried to add: EX_retfa[e]
Warning: Model already has the same reaction you tried to add: EX_retinol[e]
Warning: Model already has the same reaction you tried to add: EX_retinol_9_cis[e]
Warning: Model already has the same reaction you tried to add: EX_retinol_cis_11[e]
Warning: Model already has the same reaction you tried to add: EX_retn[e]
Warning: Model already has the same reaction you tried to add: EX_retnglc[e]
Warning: Model already has the same reaction you tried to add: EX_Rtotal[e]
Warning: Model already has the same reaction you tried to add: EX_Rtotal2[e]
Warning: Model already has the same reaction you tried to add: EX_Rtotal3[e]
Warning: Model already has the same reaction you tried to add: EX_s2l2fn2m2masn[e]
Warning: Model already has the same reaction you tried to add: EX_s2l2n2m2masn[e]
Warning: Model already has the same reaction you tried to add: EX_sarcs[e]
DM_ser_D[e] ser_D[e]  ->
Warning: Model already has the same reaction you tried to add: EX_sl_L[e]
Warning: Model already has the same reaction you tried to add: EX_spc_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sph1p[e]
Warning: Model already has the same reaction you tried to add: EX_sphs1p[e]
Warning: Model already has the same reaction you tried to add: EX_srtn[e]
Warning: Model already has the same reaction you tried to add: EX_strdnc[e]
Warning: Model already has the same reaction you tried to add: EX_tag_hs[e]
Warning: Model already has the same reaction you tried to add: EX_tagat_D[e]
Warning: Model already has the same reaction you tried to add: EX_taxol[e]
Warning: Model already has the same reaction you tried to add: EX_tchola[e]
Warning: Model already has the same reaction you tried to add: EX_tcynt[e]
Warning: Model already has the same reaction you tried to add: EX_tdchola[e]
Warning: Model already has the same reaction you tried to add: EX_tethex3[e]
Warning: Model already has the same reaction you tried to add: EX_tetpent3[e]
Warning: Model already has the same reaction you tried to add: EX_tetpent6[e]
Warning: Model already has the same reaction you tried to add: EX_tettet6[e]
Warning: Model already has the same reaction you tried to add: EX_thf[e]
Warning: Model already has the same reaction you tried to add: EX_thmmp[e]
Warning: Model already has the same reaction you tried to add: EX_thmtp[e]
Warning: Model already has the same reaction you tried to add: EX_thym[e]
Warning: Model already has the same reaction you tried to add: EX_thyox_L[e]
Warning: Model already has the same reaction you tried to add: EX_tmndnc[e]
Warning: Model already has the same reaction you tried to add: EX_tolbutamide[e]
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Warning: Model already has the same reaction you tried to add: EX_triodthy[e]
Warning: Model already has the same reaction you tried to add: EX_triodthysuf[e]
Warning: Model already has the same reaction you tried to add: EX_tststerone[e]
Warning: Model already has the same reaction you tried to add: EX_tststeroneglc[e]
Warning: Model already has the same reaction you tried to add: EX_tststerones[e]
Warning: Model already has the same reaction you tried to add: EX_tsul[e]
Warning: Model already has the same reaction you tried to add: EX_ttdca[e]
Warning: Model already has the same reaction you tried to add: EX_txa2[e]
Warning: Model already has the same reaction you tried to add: EX_tymsf[e]
Warning: Model already has the same reaction you tried to add: EX_Tyr_ggn[e]
Warning: Model already has the same reaction you tried to add: EX_udp[e]
Warning: Model already has the same reaction you tried to add: EX_ump[e]
Warning: Model already has the same reaction you tried to add: EX_urate[e]
Warning: Model already has the same reaction you tried to add: EX_utp[e]
Warning: Model already has the same reaction you tried to add: EX_vacc[e]
Warning: Model already has the same reaction you tried to add: EX_vitd3[e]
Warning: Model already has the same reaction you tried to add: EX_whddca[e]
Warning: Model already has the same reaction you tried to add: EX_whhdca[e]
Warning: Model already has the same reaction you tried to add: EX_whtststerone[e]
Warning: Model already has the same reaction you tried to add: EX_whttdca[e]
Warning: Model already has the same reaction you tried to add: EX_xolest_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xolest2_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xoltri24[e]
Warning: Model already has the same reaction you tried to add: EX_xoltri25[e]
Warning: Model already has the same reaction you tried to add: EX_xoltri27[e]
Warning: Model already has the same reaction you tried to add: EX_xylt[e]
Warning: Model already has the same reaction you tried to add: EX_yvite[e]

DM_f1a[g] f1a[g]  ->
DM_f1a[l] f1a[l]  ->
DM_fuc1p_L[c] fuc1p_L[c]  ->
DM_gdpfuc[c] gdpfuc[c]  ->
DM_gdp[g] gdp[g]  ->
DM_gdpfuc[g] gdpfuc[g]  ->
DM_ddca[c] ddca[c]  ->
DM_ttdca[c] ttdca[c]  ->
DM_ttdcea[c] ttdcea[c]  ->
Warning: Model already has the same reaction you tried to add: sink_hdca[c]

DM_hdcea[c] hdcea[c]  ->
DM_ocdca[c] ocdca[c]  ->
DM_ocdcea[c] ocdcea[c]  ->
Warning: Model already has the same reaction you tried to add: sink_lnlc[c]

DM_lneldc[c] lneldc[c]  ->
DM_ptdca[c] ptdca[c]  ->
DM_ptdcacoa[c] ptdcacoa[c]  ->
DM_hpdca[c] hpdca[c]  ->
DM_hpdcacoa[c] hpdcacoa[c]  ->
DM_vacc[c] vacc[c]  ->
DM_lnlncg[c] lnlncg[c]  ->
DM_lnlnca[c] lnlnca[c]  ->
DM_strdnc[c] strdnc[c]  ->
DM_pristcoa[c] pristcoa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tmndnc[c]

DM_phyt[c] phyt[c]  ->
DM_phytcoa[c] phytcoa[c]  ->
DM_lgnc[c] lgnc[c]  ->
DM_nrvnc[c] nrvnc[c]  ->
DM_tettet6[c] tettet6[c]  ->
DM_tetpent6[c] tetpent6[c]  ->
DM_tetpent3[c] tetpent3[c]  ->
DM_tethex3[c] tethex3[c]  ->
DM_hexc[c] hexc[c]  ->
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DM_occoa[c] occoa[c]  ->
DM_octa[c] octa[c]  ->
DM_malcoa[c] malcoa[c]  ->
DM_whddca[c] whddca[c]  ->
DM_whttdca[c] whttdca[c]  ->
DM_whhdca[c] whhdca[c]  ->
DM_fald[c] fald[c]  ->
DM_Sfglutth[c] Sfglutth[c]  ->
DM_fald[l] fald[l]  ->
DM_tdcoa[m] tdcoa[m]  ->
DM_ptdcacoa[m] ptdcacoa[m]  ->
DM_occoa[m] occoa[m]  ->
DM_hpdcacoa[m] hpdcacoa[m]  ->
DM_stcoa[x] stcoa[x]  ->
DM_octd11ecoa[m] octd11ecoa[m]  ->
DM_lnlccoa[m] lnlccoa[m]  ->
DM_lneldccoa[m] lneldccoa[m]  ->
DM_lnlncacoa[m] lnlncacoa[m]  ->
DM_lnlncgcoa[m] lnlncgcoa[m]  ->
DM_lnlncgcoa[x] lnlncgcoa[x]  ->
DM_strdnccoa[m] strdnccoa[m]  ->
DM_strdnccoa[x] strdnccoa[x]  ->
DM_tmndnccoa[m] tmndnccoa[m]  ->
DM_tmndnccoa[x] tmndnccoa[x]  ->
DM_odecoa[x] odecoa[x]  ->
DM_nrvnccoa[x] nrvnccoa[x]  ->
DM_tettet6coa[x] tettet6coa[x]  ->
DM_tetpent3coa[x] tetpent3coa[x]  ->
DM_tetpent6coa[x] tetpent6coa[x]  ->
DM_tethex3coa[x] tethex3coa[x]  ->
DM_hexccoa[x] hexccoa[x]  ->
DM_dcacoa[c] dcacoa[c]  ->
DM_ddcacoa[c] ddcacoa[c]  ->
DM_xu1p_D[c] xu1p_D[c]  ->
DM_gcald[c] gcald[c]  ->
DM_glyald[c] glyald[c]  ->
DM_tag1p_D[c] tag1p_D[c]  ->
DM_f6p[c] f6p[c]  ->
DM_f26bp[c] f26bp[c]  ->
DM_fe2[m] fe2[m]  ->
DM_pheme[m] pheme[m]  ->
DM_ppp9[m] ppp9[m]  ->
DM_formcoa[c] formcoa[c]  ->
Warning: Model already has the same reaction you tried to add: EX_fe2[e]

DM_fe2[c] fe2[c]  ->
Warning: Model already has the same reaction you tried to add: EX_fe3[e]

DM_fuc_L[c] fuc_L[c]  ->
DM_Lfmkynr[c] Lfmkynr[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_Lkynr[c] Lkynr[c]  ->
Warning: Model already has the same reaction you tried to add: DM_fol
Warning: Model already has the same reaction you tried to add: EX_fol[e]

DM_formcoa[x] formcoa[x]  ->
DM_for[m] for[m]  ->
DM_for[r] for[r]  ->
DM_5dhf[m] 5dhf[m]  ->
DM_thf[m] thf[m]  ->
DM_frdp[x] frdp[x]  ->
DM_frdp[r] frdp[r]  ->
Warning: Model already has the same reaction you tried to add: EX_fru[e]

DM_fru[c] fru[c]  ->
Warning: Model already has the same reaction you tried to add: sink_thf[c]

DM_fuc13galacglcgal14acglcgalgluside_hs[c] fuc13galacglcgal14acglcgalgluside_hs[c]  ->
DM_fuc13galacglcgal14acglcgalgluside_hs[g] fuc13galacglcgal14acglcgalgluside_hs[g]  ->
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DM_fuc14galacglcgalgluside_hs[c] fuc14galacglcgalgluside_hs[c]  ->
DM_fuc14galacglcgalgluside_hs[g] fuc14galacglcgalgluside_hs[g]  ->
DM_fucacgalfucgalacglcgalgluside_hs[c] fucacgalfucgalacglcgalgluside_hs[c]  ->
DM_fucacgalfucgalacglcgalgluside_hs[g] fucacgalfucgalacglcgalgluside_hs[g]  ->
DM_fucacngal14acglcgalgluside_hs[c] fucacngal14acglcgalgluside_hs[c]  ->
DM_fucacngal14acglcgalgluside_hs[g] fucacngal14acglcgalgluside_hs[g]  ->
DM_fucacngalacglcgalgluside_hs[c] fucacngalacglcgalgluside_hs[c]  ->
DM_fucacngalacglcgalgluside_hs[g] fucacngalacglcgalgluside_hs[g]  ->
DM_fuc_L[l] fuc_L[l]  ->
DM_ksi[l] ksi[l]  ->
DM_ksi_deg1[l] ksi_deg1[l]  ->
DM_s2l2fn2m2masn[l] s2l2fn2m2masn[l]  ->
DM_s2l2n2m2masn[l] s2l2n2m2masn[l]  ->
DM_fucfuc12gal14acglcgalgluside_hs[c] fucfuc12gal14acglcgalgluside_hs[c]  ->
DM_fucfuc12gal14acglcgalgluside_hs[g] fucfuc12gal14acglcgalgluside_hs[g]  ->
DM_fucfuc132galacglcgal14acglcgalgluside_hs[c] fucfuc132galacglcgal14acglcgalgluside_hs[c]  ->
DM_fucfuc132galacglcgal14acglcgalgluside_hs[g] fucfuc132galacglcgal14acglcgalgluside_hs[g]  ->
DM_fucfucfucgalacglc13galacglcgal14acglcgalgluside_hs[c] fucfucfucgalacglc13galacglcgal14acglcgalgluside
DM_fucfucfucgalacglc13galacglcgal14acglcgalgluside_hs[g] fucfucfucgalacglc13galacglcgal14acglcgalgluside
DM_fucfucfucgalacglcgal14acglcgalgluside_hs[c] fucfucfucgalacglcgal14acglcgalgluside_hs[c]  ->
DM_fucfucfucgalacglcgal14acglcgalgluside_hs[g] fucfucfucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_fucfucgalacglcgalgluside_hs[c] fucfucgalacglcgalgluside_hs[c]  ->
DM_fucfucgalacglcgalgluside_hs[g] fucfucgalacglcgalgluside_hs[g]  ->
DM_fucgal14acglcgalgluside_hs[c] fucgal14acglcgalgluside_hs[c]  ->
DM_fucgal14acglcgalgluside_hs[g] fucgal14acglcgalgluside_hs[g]  ->
DM_fucgalfucgalacglcgalgluside_hs[c] fucgalfucgalacglcgalgluside_hs[c]  ->
DM_fucgalfucgalacglcgalgluside_hs[g] fucgalfucgalacglcgalgluside_hs[g]  ->
DM_fucgalgbside_hs[c] fucgalgbside_hs[c]  ->
DM_fucgalgbside_hs[g] fucgalgbside_hs[g]  ->
DM_4fumacac[c] 4fumacac[c]  ->
DM_fum[m] fum[m]  ->
DM_so4[m] so4[m]  ->
DM_so4[c] so4[c]  ->
DM_tsul[m] tsul[m]  ->
DM_tsul[c] tsul[c]  ->
DM_acngalacglcgalgluside_hs[g] acngalacglcgalgluside_hs[g]  ->
DM_fucgalacglc13galacglcgal14acglcgalgluside_hs[g] fucgalacglc13galacglcgal14acglcgalgluside_hs[g]  ->
DM_fucfucgalacglc13galacglcgal14acglcgalgluside_hs[g] fucfucgalacglc13galacglcgal14acglcgalgluside_hs[g]
DM_acngal14acglcgalgluside_hs[g] acngal14acglcgalgluside_hs[g]  ->
DM_fucfucgalacglcgal14acglcgalgluside_hs[g] fucfucgalacglcgal14acglcgalgluside_hs[g]  ->
DM_fuc132galacglcgal14acglcgalgluside_hs[g] fuc132galacglcgal14acglcgalgluside_hs[g]  ->
DM_ksii_core4_pre1[g] ksii_core4_pre1[g]  ->
DM_ksii_core4_pre6[g] ksii_core4_pre6[g]  ->
DM_ksii_core4_pre9[g] ksii_core4_pre9[g]  ->
DM_ksii_core4_pre10[g] ksii_core4_pre10[g]  ->
DM_ksii_core2_pre1[g] ksii_core2_pre1[g]  ->
DM_ksii_core2_pre6[g] ksii_core2_pre6[g]  ->
DM_ksii_core2_pre9[g] ksii_core2_pre9[g]  ->
DM_ksii_core2_pre10[g] ksii_core2_pre10[g]  ->
DM_glyc3p[c] glyc3p[c]  ->
DM_glu5sa[m] glu5sa[m]  ->
DM_1pyr5c[m] 1pyr5c[m]  ->
DM_glu5p[m] glu5p[m]  ->
DM_6pgl[r] 6pgl[r]  ->
DM_g6p[c] g6p[c]  ->
DM_gudac[c] gudac[c]  ->
DM_gacpail_hs[c] gacpail_hs[c]  ->
DM_gacpail_hs[r] gacpail_hs[r]  ->
DM_paps[g] paps[g]  ->
DM_pap[g] pap[g]  ->
DM_sgalside_hs[g] sgalside_hs[g]  ->
DM_galside_hs[g] galside_hs[g]  ->
DM_galacglcgalgbside_hs[c] galacglcgalgbside_hs[c]  ->
DM_gal[l] gal[l]  ->
DM_ksi_deg26[l] ksi_deg26[l]  ->
DM_ksi_deg27[l] ksi_deg27[l]  ->
DM_ksi_deg29[l] ksi_deg29[l]  ->
DM_ksi_deg30[l] ksi_deg30[l]  ->
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DM_ksi_deg32[l] ksi_deg32[l]  ->
DM_ksi_deg33[l] ksi_deg33[l]  ->
DM_ksi_deg35[l] ksi_deg35[l]  ->
DM_ksi_deg36[l] ksi_deg36[l]  ->
DM_ksi_deg38[l] ksi_deg38[l]  ->
DM_ksi_deg39[l] ksi_deg39[l]  ->
DM_ksi_deg40[l] ksi_deg40[l]  ->
DM_ksi_deg41[l] ksi_deg41[l]  ->
DM_ksii_core2_deg2[l] ksii_core2_deg2[l]  ->
DM_ksii_core2_deg3[l] ksii_core2_deg3[l]  ->
DM_ksii_core2_deg5[l] ksii_core2_deg5[l]  ->
DM_ksii_core2_deg6[l] ksii_core2_deg6[l]  ->
DM_ksii_core2_deg8[l] ksii_core2_deg8[l]  ->
DM_ksii_core2_deg9[l] ksii_core2_deg9[l]  ->
DM_core6[l] core6[l]  ->
DM_l2n2m2mn[l] l2n2m2mn[l]  ->
DM_ksii_core4_deg2[l] ksii_core4_deg2[l]  ->
DM_ksii_core4_deg3[l] ksii_core4_deg3[l]  ->
DM_ksi_deg5[l] ksi_deg5[l]  ->
DM_ksi_deg6[l] ksi_deg6[l]  ->
DM_ksi_deg8[l] ksi_deg8[l]  ->
DM_ksi_deg9[l] ksi_deg9[l]  ->
DM_ksi_deg11[l] ksi_deg11[l]  ->
DM_ksi_deg12[l] ksi_deg12[l]  ->
DM_ksi_deg14[l] ksi_deg14[l]  ->
DM_ksi_deg15[l] ksi_deg15[l]  ->
DM_ksi_deg17[l] ksi_deg17[l]  ->
DM_ksi_deg18[l] ksi_deg18[l]  ->
DM_ksi_deg20[l] ksi_deg20[l]  ->
DM_ksi_deg21[l] ksi_deg21[l]  ->
DM_ksi_deg23[l] ksi_deg23[l]  ->
DM_ksi_deg24[l] ksi_deg24[l]  ->
DM_galfuc12gal14acglcgalgluside_hs[c] galfuc12gal14acglcgalgluside_hs[c]  ->
DM_galfucgalacglcgal14acglcgalgluside_hs[c] galfucgalacglcgal14acglcgalgluside_hs[c]  ->
DM_galgalfucfucgalacglcgalacglcgal14acglcgalgluside_hs[c] galgalfucfucgalacglcgalacglcgal14acglcgalglusi
DM_galgalgalthcrm_hs[c] galgalgalthcrm_hs[c]  ->
DM_galgluside_hs[l] galgluside_hs[l]  ->
DM_gm3_hs[g] gm3_hs[g]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gd3_hs[g] gd3_hs[g]  ->
DM_gt3_hs[g] gt3_hs[g]  ->
DM_cs_hs_linkage[g] cs_hs_linkage[g]  ->
DM_cs_pre[g] cs_pre[g]  ->
DM_cs_a_b_pre2[g] cs_a_b_pre2[g]  ->
DM_cs_a_b_pre3[g] cs_a_b_pre3[g]  ->
DM_cs_c_pre2[g] cs_c_pre2[g]  ->
DM_cs_c_pre3[g] cs_c_pre3[g]  ->
DM_cs_d_pre3[g] cs_d_pre3[g]  ->
DM_cs_d_pre4[g] cs_d_pre4[g]  ->
DM_cs_e_pre3[g] cs_e_pre3[g]  ->
DM_cs_e_pre4[g] cs_e_pre4[g]  ->
DM_Ser_Thr[g] Ser_Thr[g]  ->
DM_gal[c] gal[c]  ->
DM_galt[c] galt[c]  ->
DM_galside_hs[c] galside_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gal[e]

DM_lxser[g] lxser[g]  ->
DM_l2xser[g] l2xser[g]  ->
DM_xser[g] xser[g]  ->
Warning: Model already has the same reaction you tried to add: EX_gam[e]

DM_gam[c] gam[c]  ->
Warning: Model already has the same reaction you tried to add: EX_malt[e]

DM_oagd3_hs[c] oagd3_hs[c]  ->
DM_gd3_hs[c] gd3_hs[c]  ->
DM_oagd3_hs[g] oagd3_hs[g]  ->
DM_oagt3_hs[c] oagt3_hs[c]  ->
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DM_gt3_hs[c] gt3_hs[c]  ->
DM_oagt3_hs[g] oagt3_hs[g]  ->
DM_gar[c] gar[c]  ->
DM_fgam[c] fgam[c]  ->
DM_n2m2nmasn[l] n2m2nmasn[l]  ->
DM_glc_D[l] glc_D[l]  ->
DM_gluside_hs[l] gluside_hs[l]  ->
DM_gbside_hs[c] gbside_hs[c]  ->
DM_gbside_hs[l] gbside_hs[l]  ->
DM_gcald[m] gcald[m]  ->
DM_glyclt[m] glyclt[m]  ->
DM_lpam[m] lpam[m]  ->
DM_alpam[m] alpam[m]  ->
DM_mlthf[m] mlthf[m]  ->
DM_dhlam[m] dhlam[m]  ->
DM_lpro[m] lpro[m]  ->
DM_alpro[m] alpro[m]  ->
DM_dhlpro[m] dhlpro[m]  ->
Warning: Model already has the same reaction you tried to add: sink_gchola[c]

DM_gd1b2_hs[c] gd1b2_hs[c]  ->
DM_gd1b2_hs[g] gd1b2_hs[g]  ->
DM_gd1c_hs[c] gd1c_hs[c]  ->
DM_gd1c_hs[g] gd1c_hs[g]  ->
DM_gmp[g] gmp[g]  ->
DM_gmp[c] gmp[c]  ->
DM_gdpddman[c] gdpddman[c]  ->
DM_glu_L[l] glu_L[l]  ->
DM_thf[l] thf[l]  ->
DM_5oxpro[c] 5oxpro[c]  ->
Warning: Model already has the same reaction you tried to add: sink_Tyr_ggn[c]

DM_udpg[c] udpg[c]  ->
DM_ggn[c] ggn[c]  ->
DM_ttc_ggdp[c] ttc_ggdp[c]  ->
DM_glu_L[r] glu_L[r]  ->
DM_leuktrC4[r] leuktrC4[r]  ->
DM_leuktrD4[r] leuktrD4[r]  ->
DM_leuktrE4[c] leuktrE4[c]  ->
DM_leuktrF4[c] leuktrF4[c]  ->
DM_ser_L[m] ser_L[m]  ->
DM_3htmelys[c] 3htmelys[c]  ->
DM_4tmeabut[c] 4tmeabut[c]  ->
DM_glac[c] glac[c]  ->
DM_glcr[c] glcr[c]  ->
DM_glac[r] glac[r]  ->
Warning: Model already has the same reaction you tried to add: sink_glygn2[c]

DM_glygn1[c] glygn1[c]  ->
DM_hs_deg9[l] hs_deg9[l]  ->
DM_glcur[l] glcur[l]  ->
DM_hs_deg10[l] hs_deg10[l]  ->
DM_cs_a_deg2[l] cs_a_deg2[l]  ->
DM_cs_a_deg3[l] cs_a_deg3[l]  ->
DM_cs_c_deg2[l] cs_c_deg2[l]  ->
DM_cs_c_deg3[l] cs_c_deg3[l]  ->
DM_cs_d_deg3[l] cs_d_deg3[l]  ->
DM_cs_d_deg4[l] cs_d_deg4[l]  ->
DM_cs_e_deg3[l] cs_e_deg3[l]  ->
DM_cs_e_deg4[l] cs_e_deg4[l]  ->
DM_ha[l] ha[l]  ->
DM_ha_deg1[l] ha_deg1[l]  ->
DM_ha_pre1[l] ha_pre1[l]  ->
DM_cs_b_pre4[g] cs_b_pre4[g]  ->
DM_hs_pre10[g] hs_pre10[g]  ->
DM_hs_pre11[g] hs_pre11[g]  ->
DM_cs_a_b_e_pre1[g] cs_a_b_e_pre1[g]  ->
DM_udpglcur[g] udpglcur[g]  ->
DM_cs_c_d_e_pre1[g] cs_c_d_e_pre1[g]  ->
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DM_cs_d_pre2[g] cs_d_pre2[g]  ->
DM_cs_e_pre2[g] cs_e_pre2[g]  ->
DM_hs_pre1[g] hs_pre1[g]  ->
DM_hs_pre2[g] hs_pre2[g]  ->
DM_hs_pre3[g] hs_pre3[g]  ->
DM_hs_pre4[g] hs_pre4[g]  ->
DM_hs_pre5[g] hs_pre5[g]  ->
DM_hs_pre6[g] hs_pre6[g]  ->
DM_hs_pre7[g] hs_pre7[g]  ->
DM_hs_pre8[g] hs_pre8[g]  ->
DM_hs_deg3[l] hs_deg3[l]  ->
DM_hs_deg4[l] hs_deg4[l]  ->
DM_hs_deg8[l] hs_deg8[l]  ->
DM_hs_deg14[l] hs_deg14[l]  ->
DM_hs_deg15[l] hs_deg15[l]  ->
DM_hs_deg20[l] hs_deg20[l]  ->
DM_hs_deg21[l] hs_deg21[l]  ->
DM_hs_deg24[l] hs_deg24[l]  ->
DM_hs_deg25[l] hs_deg25[l]  ->
DM_hs_pre9[g] hs_pre9[g]  ->
DM_uacgam[c] uacgam[c]  ->
DM_ump[c] ump[c]  ->
DM_glc_D[g] glc_D[g]  ->
DM_glcur[c] glcur[c]  ->
DM_glcur[r] glcur[r]  ->
DM_dxtrn[c] dxtrn[c]  ->
DM_glygn3[c] glygn3[c]  ->
DM_guln[r] guln[r]  ->
DM_gullac[r] gullac[r]  ->
DM_gln_L[m] gln_L[m]  ->
DM_gullac[c] gullac[c]  ->
DM_glucys[c] glucys[c]  ->
DM_5forthf[c] 5forthf[c]  ->
DM_forglu[c] forglu[c]  ->
DM_oxa[x] oxa[x]  ->
DM_glx[c] glx[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glyb[e]
DM_glyc3p[m] glyc3p[m]  ->
DM_2pg[c] 2pg[c]  ->
DM_glyc_R[c] glyc_R[c]  ->
DM_glyclt[c] glyclt[c]  ->
DM_glyclt[x] glyclt[x]  ->
DM_glyc_S[c] glyc_S[c]  ->
DM_glyc[c] glyc[c]  ->
DM_glyc[m] glyc[m]  ->
DM_gthrd[m] gthrd[m]  ->
DM_lgt_S[m] lgt_S[m]  ->
DM_gmp[n] gmp[n]  ->
DM_6pgc[r] 6pgc[r]  ->
DM_ru5p_D[r] ru5p_D[r]  ->
DM_sarcs[c] sarcs[c]  ->
DM_gp1calpha_hs[c] gp1calpha_hs[c]  ->
DM_gp1calpha_hs[g] gp1calpha_hs[g]  ->
DM_gp1c_hs[c] gp1c_hs[c]  ->
DM_gp1c_hs[g] gp1c_hs[g]  ->
DM_hdca[r] hdca[r]  ->
DM_em2emgacpail_prot_hs[r] em2emgacpail_prot_hs[r]  ->
DM_gpi_prot_hs[r] gpi_prot_hs[r]  ->
DM_mgacpail_hs[r] mgacpail_hs[r]  ->
DM_gq1balpha_hs[c] gq1balpha_hs[c]  ->
DM_gq1balpha_hs[g] gq1balpha_hs[g]  ->
DM_gq1b_hs[c] gq1b_hs[c]  ->
DM_gq1b_hs[g] gq1b_hs[g]  ->
DM_gsn[c] gsn[c]  ->
DM_gsn[l] gsn[l]  ->
DM_gt1a_hs[c] gt1a_hs[c]  ->
DM_gt1a_hs[g] gt1a_hs[g]  ->
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DM_gthox[m] gthox[m]  ->
DM_gthrd[r] gthrd[r]  ->
DM_gua[c] gua[c]  ->
DM_xan[c] xan[c]  ->
DM_guln[c] guln[c]  ->
DM_glcur1p[c] glcur1p[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_pe_hs[r] pe_hs[r]  ->
DM_emgacpail_hs[r] emgacpail_hs[r]  ->
DM_m2gacpail_hs[r] m2gacpail_hs[r]  ->
DM_h2o2[l] h2o2[l]  ->
DM_h2o2[n] h2o2[n]  ->
DM_m3gacpail_hs[r] m3gacpail_hs[r]  ->
DM_em3gacpail_hs[r] em3gacpail_hs[r]  ->
DM_emem2gacpail_hs[r] emem2gacpail_hs[r]  ->
DM_em2emgacpail_hs[r] em2emgacpail_hs[r]  ->
DM_m3emgacpail_hs[r] m3emgacpail_hs[r]  ->
DM_gpi_hs[r] gpi_hs[r]  ->
DM_mem2emgacpail_hs[r] mem2emgacpail_hs[r]  ->
Warning: Model already has the same reaction you tried to add: sink_pre_prot[r]
DM_udpglcur[c] udpglcur[c]  ->
DM_hcoumarin[c] hcoumarin[c]  ->
DM_hestratriol[c] hestratriol[c]  ->
DM_hestratriol[r] hestratriol[r]  ->
DM_4mlacac[c] 4mlacac[c]  ->
Warning: Model already has the same reaction you tried to add: sink_his_L[c]
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_hista[c] hista[c]  ->
Warning: Model already has the same reaction you tried to add: EX_his_L[e]
DM_im4act[c] im4act[c]  ->
DM_aacoa[c] aacoa[c]  ->
DM_hmgcoa[c] hmgcoa[c]  ->
DM_hmgcoa[m] hmgcoa[m]  ->
DM_hmgcoa[x] hmgcoa[x]  ->
DM_hom_L[c] hom_L[c]  ->
DM_pheme[c] pheme[c]  ->
DM_pristanal[x] pristanal[x]  ->
DM_phyt2ohcoa[x] phyt2ohcoa[x]  ->
DM_hpdcacrn[c] hpdcacrn[c]  ->
DM_hpdcacrn[m] hpdcacrn[m]  ->
DM_hpyr[c] hpyr[c]  ->
DM_hpyr[m] hpyr[m]  ->
DM_hpyr[x] hpyr[x]  ->
DM_hretn[c] hretn[c]  ->
DM_hs_deg1[l] hs_deg1[l]  ->
DM_hs_deg2[l] hs_deg2[l]  ->
DM_hs_deg6[l] hs_deg6[l]  ->
DM_hs_deg7[l] hs_deg7[l]  ->
DM_hs_deg12[l] hs_deg12[l]  ->
DM_hs_deg13[l] hs_deg13[l]  ->
DM_hs_deg18[l] hs_deg18[l]  ->
DM_hs_deg19[l] hs_deg19[l]  ->
DM_cortsn[r] cortsn[r]  ->
DM_tststerone[r] tststerone[r]  ->
DM_andrstndn[r] andrstndn[r]  ->
DM_nadph[x] nadph[x]  ->
DM_nadp[x] nadp[x]  ->
DM_cholcoaone[x] cholcoaone[x]  ->
DM_eandrstrn[r] eandrstrn[r]  ->
DM_andrstandn[r] andrstandn[r]  ->
DM_prgnlone[c] prgnlone[c]  ->
DM_prgstrn[r] prgstrn[r]  ->
DM_prgnlone[r] prgnlone[r]  ->
DM_17ahprgnlone[c] 17ahprgnlone[c]  ->
DM_17ahprgstrn[c] 17ahprgstrn[c]  ->
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DM_17ahprgnlone[r] 17ahprgnlone[r]  ->
DM_17ahprgstrn[r] 17ahprgstrn[r]  ->
DM_xol7aone[r] xol7aone[r]  ->
DM_xol7a[r] xol7a[r]  ->
DM_hspg[l] hspg[l]  ->
DM_hs[l] hs[l]  ->
DM_hspg[g] hspg[g]  ->
DM_htaxol[c] htaxol[c]  ->
DM_hxan[c] hxan[c]  ->
DM_hxan[x] hxan[x]  ->
Warning: Model already has the same reaction you tried to add: sink_pydam[c]
DM_pyam5p[c] pyam5p[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_taur[c] taur[c]  ->
DM_icit[c] icit[c]  ->
DM_icit[x] icit[x]  ->
DM_3ityr_L[c] 3ityr_L[c]  ->
DM_iodine[c] iodine[c]  ->
DM_35diotyr[c] 35diotyr[c]  ->
DM_triodthy[c] triodthy[c]  ->
DM_thyox_L[c] thyox_L[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tyr_L[c]
DM_hs_deg5[l] hs_deg5[l]  ->
DM_idour[l] idour[l]  ->
DM_hs_deg16[l] hs_deg16[l]  ->
DM_hs_deg17[l] hs_deg17[l]  ->
DM_hs_deg22[l] hs_deg22[l]  ->
DM_hs_deg23[l] hs_deg23[l]  ->
DM_cs_b_deg3[l] cs_b_deg3[l]  ->
DM_idour[c] idour[c]  ->
DM_idp[n] idp[n]  ->
Warning: Model already has the same reaction you tried to add: EX_ile_L[e]
Warning: Model already has the same reaction you tried to add: sink_ile_L[c]
DM_ile_L[m] ile_L[m]  ->
DM_itacon[m] itacon[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_itp[n] itp[n]  ->
DM_f1p[c] f1p[c]  ->
DM_xylu_D[c] xylu_D[c]  ->
DM_tagat_D[c] tagat_D[c]  ->
DM_ksii_core2[g] ksii_core2[g]  ->
DM_ksii_core2[l] ksii_core2[l]  ->
DM_ksii_core4[g] ksii_core4[g]  ->
DM_ksii_core4[l] ksii_core4[l]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_k[g] k[g]  ->
Warning: Model already has the same reaction you tried to add: DM_anth
DM_4aphdob[c] 4aphdob[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_kynate[c] kynate[c]  ->
Warning: Model already has the same reaction you tried to add: EX_lcts[e]
DM_lgt_S[c] lgt_S[c]  ->
DM_lald_L[m] lald_L[m]  ->
DM_lac_L[m] lac_L[m]  ->
DM_lcts[g] lcts[g]  ->
DM_3spyr[c] 3spyr[c]  ->
DM_leuktrA4[r] leuktrA4[r]  ->
DM_leuktrB4[c] leuktrB4[c]  ->
DM_leuktrB4[r] leuktrB4[r]  ->
DM_leuktrC4[c] leuktrC4[c]  ->
DM_leuktrD4[c] leuktrD4[c]  ->
Warning: Model already has the same reaction you tried to add: EX_leu_L[e]
Warning: Model already has the same reaction you tried to add: sink_leu_L[c]
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DM_leu_L[m] leu_L[m]  ->
DM_nformanth[c] nformanth[c]  ->
DM_limnen[c] limnen[c]  ->
DM_xyl_D[l] xyl_D[l]  ->
DM_cs_a_deg5[l] cs_a_deg5[l]  ->
DM_cs_c_deg5[l] cs_c_deg5[l]  ->
DM_cs_e_deg7[l] cs_e_deg7[l]  ->
DM_lipoate[c] lipoate[c]  ->
DM_lac_L[c] lac_L[c]  ->
DM_lneldccrn[c] lneldccrn[c]  ->
DM_lneldccrn[m] lneldccrn[m]  ->
DM_lnlccrn[c] lnlccrn[c]  ->
DM_lnlccrn[m] lnlccrn[m]  ->
DM_lnlncacrn[c] lnlncacrn[c]  ->
DM_lnlncacrn[m] lnlncacrn[m]  ->
DM_lnlncgcrn[c] lnlncgcrn[c]  ->
DM_lnlncgcrn[m] lnlncgcrn[m]  ->
DM_44mctr[c] 44mctr[c]  ->
DM_lanost[c] lanost[c]  ->
DM_lanost[r] lanost[r]  ->
DM_Ssq23epx[r] Ssq23epx[r]  ->
DM_lpchol_hs[c] lpchol_hs[c]  ->
DM_g3pc[c] g3pc[c]  ->
DM_thp2c[x] thp2c[x]  ->
DM_mag_hs[c] mag_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glyc[e]
Warning: Model already has the same reaction you tried to add: sink_retfa[c]
Warning: Model already has the same reaction you tried to add: sink_retinol[c]
Warning: Model already has the same reaction you tried to add: sink_11_cis_retfa[c]
DM_retinol_cis_11[c] retinol_cis_11[c]  ->
Warning: Model already has the same reaction you tried to add: sink_9_cis_retfa[c]
DM_retinol_9_cis[c] retinol_9_cis[c]  ->
DM_pd3[c] pd3[c]  ->
Warning: Model already has the same reaction you tried to add: sink_trp_L[c]
DM_trypta[c] trypta[c]  ->
DM_lys_L[x] lys_L[x]  ->
DM_6a2ohxnt[x] 6a2ohxnt[x]  ->
DM_3mldz[c] 3mldz[c]  ->
DM_malt[l] malt[l]  ->
DM_malt[c] malt[c]  ->
Warning: Model already has the same reaction you tried to add: EX_man[e]
DM_normete_L[c] normete_L[c]  ->
DM_3mgcoa[m] 3mgcoa[m]  ->
DM_malcoa[x] malcoa[x]  ->
DM_mercplaccys[c] mercplaccys[c]  ->
DM_mercplac[c] mercplac[c]  ->
DM_tcynt[c] tcynt[c]  ->
DM_5mdru1p[c] 5mdru1p[c]  ->
DM_mescon[m] mescon[m]  ->
DM_mescoa[m] mescoa[m]  ->
DM_fna5moxam[c] fna5moxam[c]  ->
DM_6hoxmelatn[c] 6hoxmelatn[c]  ->
DM_meoh[c] meoh[c]  ->
DM_meoh[l] meoh[l]  ->
DM_mepi[c] mepi[c]  ->
Warning: Model already has the same reaction you tried to add: EX_mepi[e]
Warning: Model already has the same reaction you tried to add: EX_met_L[e]
DM_mev_R[x] mev_R[x]  ->
DM_5pmev[x] 5pmev[x]  ->
DM_mhista[c] mhista[c]  ->
DM_minohp[c] minohp[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_mi1345p[c] mi1345p[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
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DM_mi134p[c] mi134p[c]  ->
DM_mi13p[c] mi13p[c]  ->
DM_mi34p[c] mi34p[c]  ->
DM_mi1p_D[c] mi1p_D[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mi145p[c] mi145p[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mi14p[c] mi14p[c]  ->
DM_mi4p_D[c] mi4p_D[c]  ->
DM_mi14p[n] mi14p[n]  ->
DM_mi1p_D[n] mi1p_D[n]  ->
DM_mi3p_D[c] mi3p_D[c]  ->
DM_minohp[n] minohp[n]  ->
DM_malttr[c] malttr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_malttr[e]

DM_malttr[l] malttr[l]  ->
DM_mmcoa_S[m] mmcoa_S[m]  ->
DM_mmcoa_R[m] mmcoa_R[m]  ->
DM_5mta[c] 5mta[c]  ->
DM_5mdr1p[c] 5mdr1p[c]  ->
DM_methf[m] methf[m]  ->
DM_4aabutn[c] 4aabutn[c]  ->
DM_Nacasp[c] Nacasp[c]  ->
DM_ksi_deg7[l] ksi_deg7[l]  ->
DM_ksi_deg10[l] ksi_deg10[l]  ->
DM_ksi_deg13[l] ksi_deg13[l]  ->
DM_ksi_deg16[l] ksi_deg16[l]  ->
DM_ksi_deg19[l] ksi_deg19[l]  ->
DM_ksi_deg22[l] ksi_deg22[l]  ->
DM_ksi_deg25[l] ksi_deg25[l]  ->
DM_ksi_deg28[l] ksi_deg28[l]  ->
DM_ksi_deg31[l] ksi_deg31[l]  ->
DM_ksi_deg34[l] ksi_deg34[l]  ->
DM_cs_a_deg1[l] cs_a_deg1[l]  ->
DM_ksi_deg37[l] ksi_deg37[l]  ->
DM_ksii_core2_deg4[l] ksii_core2_deg4[l]  ->
DM_ksii_core2_deg7[l] ksii_core2_deg7[l]  ->
DM_ksii_core4_deg4[l] ksii_core4_deg4[l]  ->
DM_cs_a_deg4[l] cs_a_deg4[l]  ->
DM_cs_b_deg1[l] cs_b_deg1[l]  ->
DM_cs_b_deg2[l] cs_b_deg2[l]  ->
DM_cs_c_deg1[l] cs_c_deg1[l]  ->
DM_cs_c_deg4[l] cs_c_deg4[l]  ->
DM_cs_d_deg1[l] cs_d_deg1[l]  ->
DM_cs_d_deg2[l] cs_d_deg2[l]  ->
DM_cs_d_deg5[l] cs_d_deg5[l]  ->
DM_cs_d_deg6[l] cs_d_deg6[l]  ->
DM_cs_e_deg2[l] cs_e_deg2[l]  ->
DM_cs_e_deg6[l] cs_e_deg6[l]  ->
Warning: Model already has the same reaction you tried to add: EX_nac[e]

DM_nac[c] nac[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_adprbp[c] adprbp[c]  ->
Warning: Model already has the same reaction you tried to add: DM_ncam

DM_nad[n] nad[n]  ->
DM_udp[l] udp[l]  ->
DM_udpacgal[l] udpacgal[l]  ->
DM_Tn_antigen[l] Tn_antigen[l]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_na1[g] na1[g]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_na1[x] na1[x]  ->
DM_carn[c] carn[c]  ->
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DM_udp[r] udp[r]  ->
DM_ump[r] ump[r]  ->
DM_pi[g] pi[g]  ->
DM_ump[g] ump[g]  ->
DM_nicrns[c] nicrns[c]  ->
DM_nicrnt[c] nicrnt[c]  ->
DM_nicrnt[n] nicrnt[n]  ->
DM_nifedipine[c] nifedipine[c]  ->
DM_nmn[m] nmn[m]  ->
DM_nmn[n] nmn[n]  ->
DM_nmn[c] nmn[c]  ->
DM_prpp[c] prpp[c]  ->
DM_nwharg[c] nwharg[c]  ->
DM_no[c] no[c]  ->
DM_r1p[c] r1p[c]  ->
DM_npthl[c] npthl[c]  ->
DM_nrpphrsf[c] nrpphrsf[c]  ->
DM_sT_antigen[g] sT_antigen[g]  ->
DM_dimp[c] dimp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_uri[e]
DM_uri[l] uri[l]  ->
DM_ump[l] ump[l]  ->
DM_cmp[l] cmp[l]  ->
DM_dtmp[l] dtmp[l]  ->
DM_thymd[l] thymd[l]  ->
DM_dtmp[m] dtmp[m]  ->
DM_thymd[m] thymd[m]  ->
DM_amp[l] amp[l]  ->
DM_gmp[l] gmp[l]  ->
DM_xmp[c] xmp[c]  ->
DM_o2s[m] o2s[m]  ->
DM_o2s[n] o2s[n]  ->
DM_o2s[x] o2s[x]  ->
DM_o2[n] o2[n]  ->
DM_succ[m] succ[m]  ->
DM_omeprazole[c] omeprazole[c]  ->
DM_onpthl[c] onpthl[c]  ->
DM_oretn[c] oretn[c]  ->
DM_retn[c] retn[c]  ->
DM_13_cis_oretn[c] 13_cis_oretn[c]  ->
DM_13_cis_retn[c] 13_cis_retn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_orn[e]
DM_orot5p[c] orot5p[c]  ->
DM_prgnlone[m] prgnlone[m]  ->
DM_xoltriol[m] xoltriol[m]  ->
DM_xoltetrol[m] xoltetrol[m]  ->
DM_thcholst[m] thcholst[m]  ->
DM_thcholstoic[m] thcholstoic[m]  ->
DM_xol7ah2[m] xol7ah2[m]  ->
DM_xol7ah3[m] xol7ah3[m]  ->
DM_xol7ah2al[m] xol7ah2al[m]  ->
DM_xol27oh[m] xol27oh[m]  ->
DM_taxol[c] taxol[c]  ->
DM_tolbutamide[c] tolbutamide[c]  ->
DM_perillyl[c] perillyl[c]  ->
DM_xoltri24[r] xoltri24[r]  ->
DM_xol24oh[r] xol24oh[r]  ->
DM_hnifedipine[c] hnifedipine[c]  ->
DM_whtststerone[r] whtststerone[r]  ->
DM_12harachd[r] 12harachd[r]  ->
DM_wharachd[r] wharachd[r]  ->
DM_leuktrB4woh[r] leuktrB4woh[r]  ->
DM_18harachd[r] 18harachd[r]  ->
DM_xoltri25[r] xoltri25[r]  ->
DM_xoltri27[r] xoltri27[r]  ->
DM_xol27oh[r] xol27oh[r]  ->
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DM_xoldiolone[r] xoldiolone[r]  ->
DM_leuktrB4wcooh[r] leuktrB4wcooh[r]  ->
DM_20ahchsterol[m] 20ahchsterol[m]  ->
DM_pro_L[m] pro_L[m]  ->
DM_pa_hs[r] pa_hs[r]  ->
DM_pa_hs[g] pa_hs[g]  ->
DM_pac[c] pac[c]  ->
DM_phaccoa[c] phaccoa[c]  ->
DM_ak2lgchol_hs[c] ak2lgchol_hs[c]  ->
DM_paf_hs[c] paf_hs[c]  ->
DM_pail_hs[n] pail_hs[n]  ->
DM_pail45p_hs[c] pail45p_hs[c]  ->
DM_pail45p_hs[n] pail45p_hs[n]  ->
DM_pail4p_hs[c] pail4p_hs[c]  ->
DM_pail4p_hs[n] pail4p_hs[n]  ->
DM_pan4p[c] pan4p[c]  ->
DM_ptth[c] ptth[c]  ->
DM_pchol_hs[m] pchol_hs[m]  ->
DM_pchol_hs[r] pchol_hs[r]  ->
DM_pchol_hs[g] pchol_hs[g]  ->
DM_am6sa[c] am6sa[c]  ->
DM_pcollg5hlys[c] pcollg5hlys[c]  ->
DM_amp[g] amp[g]  ->
DM_camp[g] camp[g]  ->
DM_35cgmp[g] 35cgmp[g]  ->
DM_pdx5p[c] pdx5p[c]  ->
DM_pydx5p[c] pydx5p[c]  ->
Warning: Model already has the same reaction you tried to add: sink_pydxn[c]
DM_pe_hs[m] pe_hs[m]  ->
DM_peamn[c] peamn[c]  ->
DM_pacald[c] pacald[c]  ->
DM_pristcoa[x] pristcoa[x]  ->
DM_3php[c] 3php[c]  ->
DM_prostgd2[c] prostgd2[c]  ->
DM_prostgh2[c] prostgh2[c]  ->
DM_prostgd2[r] prostgd2[r]  ->
DM_prostgh2[r] prostgh2[r]  ->
DM_prostge2[r] prostge2[r]  ->
DM_prostgi2[r] prostgi2[r]  ->
DM_pgp_hs[c] pgp_hs[c]  ->
DM_pheacgln[c] pheacgln[c]  ->
DM_1p3h5c[m] 1p3h5c[m]  ->
Warning: Model already has the same reaction you tried to add: EX_phe_L[e]
Warning: Model already has the same reaction you tried to add: sink_phe_L[c]
DM_phe_L[m] phe_L[m]  ->
DM_phpyr[m] phpyr[m]  ->
DM_thbpt4acam[c] thbpt4acam[c]  ->
DM_succ[x] succ[x]  ->
DM_phytcoa[x] phytcoa[x]  ->
Warning: Model already has the same reaction you tried to add: sink_phyQ[c]
DM_pail345p_hs[c] pail345p_hs[c]  ->
DM_pi[n] pi[n]  ->
DM_pail345p_hs[n] pail345p_hs[n]  ->
DM_pail34p_hs[c] pail34p_hs[c]  ->
DM_pail34p_hs[n] pail34p_hs[n]  ->
DM_pail3p_hs[n] pail3p_hs[n]  ->
DM_pail3p_hs[c] pail3p_hs[c]  ->
DM_pail35p_hs[c] pail35p_hs[c]  ->
DM_pail5p_hs[c] pail5p_hs[c]  ->
DM_pail35p_hs[r] pail35p_hs[r]  ->
DM_pail5p_hs[r] pail5p_hs[r]  ->
DM_pail5p_hs[n] pail5p_hs[n]  ->
DM_pail_hs[r] pail_hs[r]  ->
DM_ppmi12346p[c] ppmi12346p[c]  ->
DM_ppmi12346p[n] ppmi12346p[n]  ->
Warning: Model already has the same reaction you tried to add: DM_pnto_R
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DM_cysam[c] cysam[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pnto_R[e]

DM_pppi[c] pppi[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ppa[e]

DM_phpyr[c] phpyr[c]  ->
DM_2hyoxplac[c] 2hyoxplac[c]  ->
DM_pppg9[c] pppg9[c]  ->
DM_pppg9[m] pppg9[m]  ->
DM_pram[c] pram[c]  ->
DM_prgnlones[c] prgnlones[c]  ->
DM_prist[x] prist[x]  ->
DM_pro_D[c] pro_D[c]  ->
Warning: Model already has the same reaction you tried to add: EX_prostgh2[e]
Warning: Model already has the same reaction you tried to add: EX_prostgi2[e]

DM_prostgi2[c] prostgi2[c]  ->
Warning: Model already has the same reaction you tried to add: sink_pro_L[c]
Warning: Model already has the same reaction you tried to add: EX_pro_L[e]

DM_3hpcoa[m] 3hpcoa[m]  ->
DM_ps_hs[c] ps_hs[c]  ->
DM_ps_hs[m] ps_hs[m]  ->
DM_ptdcacrn[c] ptdcacrn[c]  ->
DM_ptdcacrn[m] ptdcacrn[m]  ->
DM_hdca[x] hdca[x]  ->
DM_phyt[x] phyt[x]  ->
DM_ahdt[c] ahdt[c]  ->
DM_6pthp[c] 6pthp[c]  ->
DM_ptrc[c] ptrc[c]  ->
DM_4abutn[c] 4abutn[c]  ->
Warning: Model already has the same reaction you tried to add: sink_pydx[c]

DM_quln[c] quln[c]  ->
DM_retinal_cis_13[c] retinal_cis_13[c]  ->
DM_retinal_11_cis[c] retinal_11_cis[c]  ->
DM_retinal_cis_9[c] retinal_cis_9[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_retn[n] retn[n]  ->
DM_ru5p_D[c] ru5p_D[c]  ->
DM_rbl_D[c] rbl_D[c]  ->
DM_rbt[c] rbt[c]  ->
DM_retinol_cis_13[c] retinol_cis_13[c]  ->
DM_retnglc[c] retnglc[c]  ->
DM_13_cis_retnglc[c] 13_cis_retnglc[c]  ->
DM_13_cis_retnglc[r] 13_cis_retnglc[r]  ->
DM_retnglc[r] retnglc[r]  ->
DM_retn[r] retn[r]  ->
DM_13_cis_retn[r] 13_cis_retn[r]  ->
Warning: Model already has the same reaction you tried to add: EX_ribflv[e]
Warning: Model already has the same reaction you tried to add: EX_rib_D[e]

DM_rib_D[c] rib_D[c]  ->
DM_rnam[c] rnam[c]  ->
DM_Rtotal3crn[c] Rtotal3crn[c]  ->
DM_Rtotal3crn[m] Rtotal3crn[m]  ->
DM_cs_d_pre5[g] cs_d_pre5[g]  ->
DM_cs_b_pre5[g] cs_b_pre5[g]  ->
DM_hs_pre12[g] hs_pre12[g]  ->
DM_hs_pre13[g] hs_pre13[g]  ->
DM_hs_pre14[g] hs_pre14[g]  ->
DM_hs_pre15[g] hs_pre15[g]  ->
DM_hs_deg11[l] hs_deg11[l]  ->
DM_cs_e_pre5a[g] cs_e_pre5a[g]  ->
DM_cs_e_pre5b[g] cs_e_pre5b[g]  ->
DM_cs_e_deg1[l] cs_e_deg1[l]  ->
DM_cs_e_deg5[l] cs_e_deg5[l]  ->
DM_ksi_deg4[l] ksi_deg4[l]  ->
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DM_ksii_core2_deg1[l] ksii_core2_deg1[l]  ->
DM_ksii_core4_deg1[l] ksii_core4_deg1[l]  ->
DM_saccrp_L[m] saccrp_L[m]  ->
DM_fald[x] fald[x]  ->
DM_sarcs[x] sarcs[x]  ->
DM_sphgn[r] sphgn[r]  ->
DM_sph1p[r] sph1p[r]  ->
DM_sphings[r] sphings[r]  ->
DM_sphs1p[r] sphs1p[r]  ->
DM_sbt_D[c] sbt_D[c]  ->
DM_selmeth[c] selmeth[c]  ->
DM_ser_D[c] ser_D[c]  ->
DM_ser_L[x] ser_L[x]  ->
DM_sgalside_hs[c] sgalside_hs[c]  ->
DM_acngalgbside_hs[g] acngalgbside_hs[g]  ->
DM_sph1p[c] sph1p[c]  ->
DM_sl_L[c] sl_L[c]  ->
DM_sphmyln_hs[g] sphmyln_hs[g]  ->
DM_sphmyln_hs[l] sphmyln_hs[l]  ->
DM_sphings[c] sphings[c]  ->
DM_spc_hs[c] spc_hs[c]  ->
DM_sphmyln_hs[c] sphmyln_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_so4[e]
DM_xolest_hs[c] xolest_hs[c]  ->
DM_sphs1p[c] sphs1p[c]  ->
DM_spmd[c] spmd[c]  ->
Warning: Model already has the same reaction you tried to add: EX_o2[e]
DM_sql[r] sql[r]  ->
DM_gm1b_hs[g] gm1b_hs[g]  ->
DM_gd1a_hs[g] gd1a_hs[g]  ->
DM_gt1b_hs[g] gt1b_hs[g]  ->
DM_gt1alpha_hs[g] gt1alpha_hs[g]  ->
DM_gq1c_hs[g] gq1c_hs[g]  ->
DM_strdnccrn[c] strdnccrn[c]  ->
DM_strdnccrn[m] strdnccrn[m]  ->
DM_so4[r] so4[r]  ->
DM_estrones[r] estrones[r]  ->
Warning: Model already has the same reaction you tried to add: EX_succ[e]
Warning: Model already has the same reaction you tried to add: EX_sucr[e]
DM_T4hcinnm[c] T4hcinnm[c]  ->
Warning: Model already has the same reaction you tried to add: EX_taur[e]
Warning: Model already has the same reaction you tried to add: sink_tchola[c]
DM_tcynt[m] tcynt[m]  ->
Warning: Model already has the same reaction you tried to add: sink_tdchola[c]
DM_tdchola[x] tdchola[x]  ->
DM_thmmp[c] thmmp[c]  ->
Warning: Model already has the same reaction you tried to add: sink_thmpp[c]
DM_thmmp[m] thmmp[m]  ->
DM_thmpp[m] thmpp[m]  ->
DM_tetpent3crn[c] tetpent3crn[c]  ->
DM_tetpent3coa[m] tetpent3coa[m]  ->
DM_tetpent3crn[m] tetpent3crn[m]  ->
DM_tetpent6crn[c] tetpent6crn[c]  ->
DM_tetpent6coa[m] tetpent6coa[m]  ->
DM_tetpent6crn[m] tetpent6crn[m]  ->
DM_tettet6crn[c] tettet6crn[c]  ->
DM_tettet6coa[m] tettet6coa[m]  ->
DM_tettet6crn[m] tettet6crn[m]  ->
DM_thcholstoic[x] thcholstoic[x]  ->
Warning: Model already has the same reaction you tried to add: EX_thymd[e]
DM_thymd[c] thymd[c]  ->
DM_thm[c] thm[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
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DM_thm[m] thm[m]  ->
Warning: Model already has the same reaction you tried to add: sink_thmtp[c]

DM_thp2c[c] thp2c[c]  ->
DM_tmlys[c] tmlys[c]  ->
DM_tmndnccrn[c] tmndnccrn[c]  ->
DM_tmndnccrn[m] tmndnccrn[m]  ->
DM_trdrd[c] trdrd[c]  ->
DM_trdox[c] trdox[c]  ->
DM_q10[c] q10[c]  ->
DM_q10h2[c] q10h2[c]  ->
DM_tre[c] tre[c]  ->
Warning: Model already has the same reaction you tried to add: EX_tre[e]

DM_triodthysuf[c] triodthysuf[c]  ->
Warning: Model already has the same reaction you tried to add: EX_trp_L[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_ts3[c] ts3[c]  ->
DM_tststeroneglc[c] tststeroneglc[c]  ->
DM_tststeroneglc[r] tststeroneglc[r]  ->
DM_tststerones[c] tststerones[c]  ->
DM_tststerone[c] tststerone[c]  ->
DM_ttdcrn[m] ttdcrn[m]  ->
DM_ttdcrn[c] ttdcrn[c]  ->
DM_txa2[c] txa2[c]  ->
DM_txa2[r] txa2[r]  ->
DM_tymsf[c] tymsf[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_tym[c] tym[c]  ->
Warning: Model already has the same reaction you tried to add: EX_tyr_L[e]

DM_tyr_L[m] tyr_L[m]  ->
DM_udpacgal[c] udpacgal[c]  ->
DM_udpglcur[r] udpglcur[r]  ->
DM_udpg[r] udpg[r]  ->
DM_udpxyl[g] udpxyl[g]  ->
DM_udpxyl[c] udpxyl[c]  ->
DM_udpxyl[r] udpxyl[r]  ->
DM_ahandrostan[r] ahandrostan[r]  ->
DM_ump[n] ump[n]  ->
Warning: Model already has the same reaction you tried to add: EX_ura[e]

DM_urate[c] urate[c]  ->
DM_urate[x] urate[x]  ->
Warning: Model already has the same reaction you tried to add: EX_urea[e]

DM_urea[c] urea[c]  ->
Warning: Model already has the same reaction you tried to add: EX_val_L[e]
Warning: Model already has the same reaction you tried to add: sink_val_L[c]

DM_val_L[m] val_L[m]  ->
Warning: Model already has the same reaction you tried to add: sink_vitd3[c]

DM_dhcholestanate[r] dhcholestanate[r]  ->
DM_thcholstoic[r] thcholstoic[r]  ->
DM_whtststerone[c] whtststerone[c]  ->
DM_xan[x] xan[x]  ->
DM_xolest2_hs[c] xolest2_hs[c]  ->
DM_xoltri24[c] xoltri24[c]  ->
DM_xoltri25[c] xoltri25[c]  ->
DM_xoltri27[c] xoltri27[c]  ->
DM_xser[r] xser[r]  ->
DM_xu5p_D[c] xu5p_D[c]  ->
DM_xylt[c] xylt[c]  ->
Warning: Model already has the same reaction you tried to add: sink_Ser_Gly_Ala_X_Gly[r]

DM_xyl_D[c] xyl_D[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4abutn[e]
Warning: Model already has the same reaction you tried to add: EX_acmana[e]
Warning: Model already has the same reaction you tried to add: EX_ahdt[e]
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Warning: Model already has the same reaction you tried to add: EX_ctp[e]
Warning: Model already has the same reaction you tried to add: EX_dgmp[e]
Warning: Model already has the same reaction you tried to add: EX_dgtp[e]
Warning: Model already has the same reaction you tried to add: EX_dha[e]
Warning: Model already has the same reaction you tried to add: EX_dhap[e]
Warning: Model already has the same reaction you tried to add: EX_dtmp[e]
Warning: Model already has the same reaction you tried to add: EX_dttp[e]
Warning: Model already has the same reaction you tried to add: EX_fad[e]
Warning: Model already has the same reaction you tried to add: EX_fald[e]
Warning: Model already has the same reaction you tried to add: EX_g1p[e]
Warning: Model already has the same reaction you tried to add: EX_HC00229[e]
Warning: Model already has the same reaction you tried to add: EX_HC00250[e]
Warning: Model already has the same reaction you tried to add: EX_HC01104[e]
Warning: Model already has the same reaction you tried to add: EX_HC01361[e]
Warning: Model already has the same reaction you tried to add: EX_HC01440[e]
Warning: Model already has the same reaction you tried to add: EX_HC01441[e]
Warning: Model already has the same reaction you tried to add: EX_HC01444[e]
Warning: Model already has the same reaction you tried to add: EX_HC01446[e]
Warning: Model already has the same reaction you tried to add: EX_HC01577[e]
Warning: Model already has the same reaction you tried to add: EX_HC01609[e]
Warning: Model already has the same reaction you tried to add: EX_HC01610[e]
Warning: Model already has the same reaction you tried to add: EX_HC01700[e]
Warning: Model already has the same reaction you tried to add: EX_HC02160[e]
Warning: Model already has the same reaction you tried to add: EX_HC02161[e]
Warning: Model already has the same reaction you tried to add: EX_itp[e]
Warning: Model already has the same reaction you tried to add: EX_orot[e]
Warning: Model already has the same reaction you tried to add: EX_prpp[e]
Warning: Model already has the same reaction you tried to add: EX_pydx5p[e]
Warning: Model already has the same reaction you tried to add: EX_udpg[e]

DM_HC00822[l] HC00822[l]  ->
DM_HC00617[c] HC00617[c]  ->
DM_HC00619[c] HC00619[c]  ->
DM_dpcoa[m] dpcoa[m]  ->
Warning: Model already has the same reaction you tried to add: EX_ppi[e]

DM_HC01672[c] HC01672[c]  ->
DM_HC01434[m] HC01434[m]  ->
DM_HC01434[x] HC01434[x]  ->
DM_HC00591[c] HC00591[c]  ->
DM_HC00591[m] HC00591[m]  ->
DM_uacgam[r] uacgam[r]  ->
DM_acmana[r] acmana[r]  ->
Warning: Model already has the same reaction you tried to add: EX_cdp[e]

DM_HC01118[r] HC01118[r]  ->
DM_lac_L[x] lac_L[x]  ->
DM_fdp[c] fdp[c]  ->
DM_HC00250[c] HC00250[c]  ->
DM_HC01496[m] HC01496[m]  ->
DM_glyc3p[x] glyc3p[x]  ->
DM_HC01668[m] HC01668[m]  ->
DM_glyald[m] glyald[m]  ->
DM_r5p[r] r5p[r]  ->
Warning: Model already has the same reaction you tried to add: EX_ptrc[e]

DM_HC01408[m] HC01408[m]  ->
DM_arachd[x] arachd[x]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_pmtcoa[r] pmtcoa[r]  ->
DM_HC00342[m] HC00342[m]  ->
DM_56dthm[m] 56dthm[m]  ->
DM_thym[m] thym[m]  ->
DM_3pg[m] 3pg[m]  ->
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DM_glyc_R[m] glyc_R[m]  ->
DM_3hpp[m] 3hpp[m]  ->
DM_HC00682[m] HC00682[m]  ->
DM_2mpdhl[m] 2mpdhl[m]  ->
DM_HC01377[m] HC01377[m]  ->
DM_HC01254[c] HC01254[c]  ->
DM_e4p[c] e4p[c]  ->
DM_HC00361[c] HC00361[c]  ->
DM_s7p[c] s7p[c]  ->
DM_HC10859[c] HC10859[c]  ->
DM_HC10859[m] HC10859[m]  ->
DM_HC10859[x] HC10859[x]  ->
DM_pmtcrn[r] pmtcrn[r]  ->
DM_pmtcrn[x] pmtcrn[x]  ->
DM_lnlccoa[r] lnlccoa[r]  ->
DM_lnlccrn[r] lnlccrn[r]  ->
DM_lnlccoa[x] lnlccoa[x]  ->
DM_lnlccrn[x] lnlccrn[x]  ->
DM_arachdcoa[r] arachdcoa[r]  ->
DM_arachdcrn[r] arachdcrn[r]  ->
DM_arachdcrn[x] arachdcrn[x]  ->
DM_hdcoa[r] hdcoa[r]  ->
DM_hdcecrn[r] hdcecrn[r]  ->
DM_HC01712[m] HC01712[m]  ->
DM_dgmp[c] dgmp[c]  ->
DM_HC00576[c] HC00576[c]  ->
DM_HC00718[c] HC00718[c]  ->
DM_mev_R[c] mev_R[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dtdp[e]

DM_fol[m] fol[m]  ->
DM_5fthf[m] 5fthf[m]  ->
DM_hxdcal[c] hxdcal[c]  ->
DM_pac[m] pac[m]  ->
DM_pacald[m] pacald[m]  ->
DM_betald[c] betald[c]  ->
DM_HC01522[c] HC01522[c]  ->
DM_HC00460[c] HC00460[c]  ->
DM_HC00900[m] HC00900[m]  ->
DM_cholcoa[r] cholcoa[r]  ->
DM_cholate[r] cholate[r]  ->
DM_pan4p[m] pan4p[m]  ->
DM_ptth[m] ptth[m]  ->
DM_L2aadp6sa[c] L2aadp6sa[c]  ->
DM_HC01501[c] HC01501[c]  ->
DM_HC01376[m] HC01376[m]  ->
DM_HC00664[c] HC00664[c]  ->
DM_HC01180[c] HC01180[c]  ->
DM_1p3h5c[c] 1p3h5c[c]  ->
DM_4hpro_LT[c] 4hpro_LT[c]  ->
Warning: Model already has the same reaction you tried to add: DM_4hrpo
Warning: Model already has the same reaction you tried to add: sink_thcholstoic[c]

DM_cholcoa[c] cholcoa[c]  ->
DM_HC01415[m] HC01415[m]  ->
DM_3odcoa[m] 3odcoa[m]  ->
DM_c8crn[m] c8crn[m]  ->
DM_c8crn[x] c8crn[x]  ->
DM_ddcacoa[m] ddcacoa[m]  ->
DM_3otdcoa[m] 3otdcoa[m]  ->
DM_2mop[c] 2mop[c]  ->
DM_HC00900[c] HC00900[c]  ->
DM_C02470[c] C02470[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC00955[e]
Warning: Model already has the same reaction you tried to add: EX_co2[e]

DM_dcholcoa[r] dcholcoa[r]  ->
DM_C02528[r] C02528[r]  ->
DM_dcholcoa[c] dcholcoa[c]  ->
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Warning: Model already has the same reaction you tried to add: sink_C02528[c]
DM_HC01412[m] HC01412[m]  ->
DM_3ohdcoa[m] 3ohdcoa[m]  ->
DM_3hddcoa[m] 3hddcoa[m]  ->
DM_dd2coa[x] dd2coa[x]  ->
DM_3hddcoa[x] 3hddcoa[x]  ->
DM_fpram[c] fpram[c]  ->
DM_HC01223[m] HC01223[m]  ->
DM_4ppcys[c] 4ppcys[c]  ->
Warning: Model already has the same reaction you tried to add: sink_dhcholestanate[c]
DM_xol7ah2al[c] xol7ah2al[c]  ->
DM_HC01397[m] HC01397[m]  ->
DM_HC01397[x] HC01397[x]  ->
DM_3htdcoa[m] 3htdcoa[m]  ->
DM_3htdcoa[x] 3htdcoa[x]  ->
DM_HC01412[x] HC01412[x]  ->
DM_3oddcoa[m] 3oddcoa[m]  ->
DM_dcacoa[m] dcacoa[m]  ->
DM_3hdcoa[m] 3hdcoa[m]  ->
DM_3hdcoa[x] 3hdcoa[x]  ->
DM_dc2coa[m] dc2coa[m]  ->
DM_dc2coa[x] dc2coa[x]  ->
DM_HC01405[m] HC01405[m]  ->
DM_HC01406[m] HC01406[m]  ->
DM_hxcoa[m] hxcoa[m]  ->
DM_HC01407[m] HC01407[m]  ->
DM_hx2coa[m] hx2coa[m]  ->
Warning: Model already has the same reaction you tried to add: sink_xol7ah3[c]
DM_xoltetrol[c] xoltetrol[c]  ->
DM_HC01459[x] HC01459[x]  ->
DM_34dhmald[m] 34dhmald[m]  ->
DM_34dhoxmand[m] 34dhoxmand[m]  ->
DM_homoval[m] homoval[m]  ->
DM_3mox4hpac[m] 3mox4hpac[m]  ->
DM_3m4hpga[m] 3m4hpga[m]  ->
DM_3mox4hoxm[m] 3mox4hoxm[m]  ->
DM_HC02228[c] HC02228[c]  ->
DM_HC01842[c] HC01842[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC00004[e]
Warning: Model already has the same reaction you tried to add: EX_citr_L[e]
DM_inost[r] inost[r]  ->
DM_HC00319[c] HC00319[c]  ->
DM_HC00319[m] HC00319[m]  ->
DM_r5p[c] r5p[c]  ->
DM_atp[l] atp[l]  ->
DM_adp[l] adp[l]  ->
DM_cmp[r] cmp[r]  ->
DM_acgam[r] acgam[r]  ->
DM_arachd[l] arachd[l]  ->
DM_hdca[l] hdca[l]  ->
Warning: Model already has the same reaction you tried to add: EX_spmd[e]
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_na1[r] na1[r]  ->
DM_strdnc[l] strdnc[l]  ->
DM_strdnc[r] strdnc[r]  ->
DM_lnlc[l] lnlc[l]  ->
DM_lnlc[r] lnlc[r]  ->
Warning: Model already has the same reaction you tried to add: EX_C02528[e]
DM_c8crn[c] c8crn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_C02470[e]
DM_thr_L[m] thr_L[m]  ->
DM_met_L[m] met_L[m]  ->
DM_his_L[m] his_L[m]  ->
DM_dtmp[c] dtmp[c]  ->
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DM_HC02110[r] HC02110[r]  ->
DM_2obut[m] 2obut[m]  ->
DM_cdpchol[r] cdpchol[r]  ->
DM_HC02020[r] HC02020[r]  ->
DM_hdd2coa[r] hdd2coa[r]  ->
DM_HC02021[r] HC02021[r]  ->
DM_stcoa[r] stcoa[r]  ->
DM_HC02022[r] HC02022[r]  ->
DM_odecoa[r] odecoa[r]  ->
DM_HC02023[r] HC02023[r]  ->
DM_HC02024[r] HC02024[r]  ->
DM_lnlncgcoa[r] lnlncgcoa[r]  ->
DM_HC02025[r] HC02025[r]  ->
DM_HC02026[r] HC02026[r]  ->
DM_HC02027[r] HC02027[r]  ->
DM_hdcea[r] hdcea[r]  ->
DM_ocdcea[r] ocdcea[r]  ->
DM_ocdcea[l] ocdcea[l]  ->
DM_lnlnca[r] lnlnca[r]  ->
DM_lnlncg[r] lnlncg[r]  ->
DM_lnlncg[l] lnlncg[l]  ->
DM_hdcea[l] hdcea[l]  ->
DM_lnlnca[l] lnlnca[l]  ->
DM_dlnlcg[l] dlnlcg[l]  ->
DM_dlnlcg[r] dlnlcg[r]  ->
Warning: Model already has the same reaction you tried to add: EX_HC00822[e]
DM_HC02121[c] HC02121[c]  ->
DM_xtsn[c] xtsn[c]  ->
DM_HC02136[c] HC02136[c]  ->
DM_btcoa[c] btcoa[c]  ->
DM_dlnlcgcoa[r] dlnlcgcoa[r]  ->
DM_HC10856[m] HC10856[m]  ->
DM_HC10857[m] HC10857[m]  ->
DM_HC10858[m] HC10858[m]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02192[e]
Warning: Model already has the same reaction you tried to add: sink_HC02192[c]
Warning: Model already has the same reaction you tried to add: EX_HC02193[e]
Warning: Model already has the same reaction you tried to add: sink_HC02193[c]
Warning: Model already has the same reaction you tried to add: EX_HC02195[e]
Warning: Model already has the same reaction you tried to add: sink_HC02195[c]
Warning: Model already has the same reaction you tried to add: EX_HC02196[e]
Warning: Model already has the same reaction you tried to add: sink_HC02196[c]
Warning: Model already has the same reaction you tried to add: EX_HC02220[e]
Warning: Model already has the same reaction you tried to add: sink_HC02220[c]
DM_dca[c] dca[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dca[e]
DM_HC02199[c] HC02199[c]  ->
DM_HC02199[e] HC02199[e]  ->
DM_HC02200[c] HC02200[c]  ->
DM_HC02200[e] HC02200[e]  ->
DM_HC02201[c] HC02201[c]  ->
DM_HC02201[e] HC02201[e]  ->
DM_zn2[e] zn2[e]  ->
DM_zn2[c] zn2[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pyr[e]
Warning: Model already has the same reaction you tried to add: EX_acac[e]
Warning: Model already has the same reaction you tried to add: EX_lac_L[e]
Warning: Model already has the same reaction you tried to add: EX_but[e]
Warning: Model already has the same reaction you tried to add: EX_HC02191[e]
Warning: Model already has the same reaction you tried to add: sink_HC02191[c]
Warning: Model already has the same reaction you tried to add: EX_HC02194[e]
Warning: Model already has the same reaction you tried to add: sink_HC02194[c]
Warning: Model already has the same reaction you tried to add: EX_HC02197[e]
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Warning: Model already has the same reaction you tried to add: sink_HC02197[c]
Warning: Model already has the same reaction you tried to add: EX_HC02198[e]
Warning: Model already has the same reaction you tried to add: sink_HC02198[c]
Warning: Model already has the same reaction you tried to add: EX_HC02187[e]

DM_HC02187[c] HC02187[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02180[e]

DM_HC02180[c] HC02180[c]  ->
Warning: Model already has the same reaction you tried to add: EX_wharachd[e]

DM_wharachd[c] wharachd[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02202[e]

DM_HC02202[c] HC02202[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02203[e]

DM_HC02203[c] HC02203[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02204[e]

DM_HC02204[c] HC02204[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02205[e]

DM_HC02205[c] HC02205[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02206[e]

DM_HC02206[c] HC02206[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02207[e]

DM_HC02207[c] HC02207[c]  ->
DM_HC02208[e] HC02208[e]  ->
DM_HC02208[c] HC02208[c]  ->
DM_HC02210[e] HC02210[e]  ->
DM_HC02210[c] HC02210[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02213[e]

DM_HC02213[c] HC02213[c]  ->
DM_HC02214[e] HC02214[e]  ->
DM_HC02214[c] HC02214[c]  ->
DM_HC02216[e] HC02216[e]  ->
DM_HC02216[c] HC02216[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02217[e]

DM_HC02217[c] HC02217[c]  ->
DM_HC00342[c] HC00342[c]  ->
DM_oxa[m] oxa[m]  ->
DM_c4crn[c] c4crn[c]  ->
DM_c4crn[m] c4crn[m]  ->
Warning: Model already has the same reaction you tried to add: EX_so3[e]
Warning: Model already has the same reaction you tried to add: EX_sprm[e]

DM_6pgc[c] 6pgc[c]  ->
DM_glcn[c] glcn[c]  ->
DM_trdrd[n] trdrd[n]  ->
DM_trdox[n] trdox[n]  ->
DM_CE2421[m] CE2421[m]  ->
DM_CE0713[m] CE0713[m]  ->
DM_CE2421[x] CE2421[x]  ->
DM_CE0713[x] CE0713[x]  ->
DM_C10164[c] C10164[c]  ->
DM_CE2251[c] CE2251[c]  ->
DM_CE2247[c] CE2247[c]  ->
DM_CE2243[c] CE2243[c]  ->
DM_CE2250[c] CE2250[c]  ->
Warning: Model already has the same reaction you tried to add: EX_coa[e]
Warning: Model already has the same reaction you tried to add: EX_malcoa[e]
Warning: Model already has the same reaction you tried to add: EX_arachcoa[e]
Warning: Model already has the same reaction you tried to add: EX_CE2250[e]

DM_CE2246[c] CE2246[c]  ->
DM_CE2242[c] CE2242[c]  ->
DM_CE2253[c] CE2253[c]  ->
DM_CE2249[c] CE2249[c]  ->
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DM_CE2245[c] CE2245[c]  ->
DM_docoscoa[c] docoscoa[c]  ->
DM_docosac[c] docosac[c]  ->
DM_docoscoa[m] docoscoa[m]  ->
DM_docoscoa[x] docoscoa[x]  ->
DM_3ohodcoa[c] 3ohodcoa[c]  ->
DM_CE2248[c] CE2248[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE1935[e]
Warning: Model already has the same reaction you tried to add: EX_CE1940[e]
Warning: Model already has the same reaction you tried to add: EX_CE1943[e]

DM_CE1944[c] CE1944[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE1936[e]
Warning: Model already has the same reaction you tried to add: EX_CE1939[e]

DM_CE2705[c] CE2705[c]  ->
DM_thbpt4acam[n] thbpt4acam[n]  ->
DM_CE2705[n] CE2705[n]  ->
DM_CE2870[c] CE2870[c]  ->
DM_CE2866[c] CE2866[c]  ->
DM_maltttr[c] maltttr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_maltttr[e]

DM_CE2873[c] CE2873[c]  ->
DM_CE2872[c] CE2872[c]  ->
DM_CE2875[c] CE2875[c]  ->
DM_CE2874[c] CE2874[c]  ->
Warning: Model already has the same reaction you tried to add: EX_maltpt[e]
Warning: Model already has the same reaction you tried to add: EX_malthx[e]
Warning: Model already has the same reaction you tried to add: EX_CE2915[e]
Warning: Model already has the same reaction you tried to add: EX_CE4722[e]
Warning: Model already has the same reaction you tried to add: EX_CE2916[e]
Warning: Model already has the same reaction you tried to add: EX_CE4723[e]
Warning: Model already has the same reaction you tried to add: EX_CE2917[e]
Warning: Model already has the same reaction you tried to add: EX_CE4724[e]
Warning: Model already has the same reaction you tried to add: EX_malthp[e]

DM_CE2839[c] CE2839[c]  ->
DM_CE2838[c] CE2838[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE2839[e]
Warning: Model already has the same reaction you tried to add: EX_CE2838[e]
Warning: Model already has the same reaction you tried to add: EX_CE1950[e]
Warning: Model already has the same reaction you tried to add: EX_cynt[e]
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DM_CE0737[c] CE0737[c]  ->
DM_CE1243[c] CE1243[c]  ->
DM_andrstndn[c] andrstndn[c]  ->
DM_CE1352[c] CE1352[c]  ->
DM_chsterols[r] chsterols[r]  ->
DM_prgnlones[r] prgnlones[r]  ->
DM_N1aspmd[c] N1aspmd[c]  ->
DM_n8aspmd[c] n8aspmd[c]  ->
DM_CE2028[c] CE2028[c]  ->
DM_atp[g] atp[g]  ->
DM_adp[g] adp[g]  ->
DM_pail_hs[g] pail_hs[g]  ->
DM_pail45p_hs[m] pail45p_hs[m]  ->
DM_CE5101[m] CE5101[m]  ->
DM_CE2434[m] CE2434[m]  ->
DM_CE2434[x] CE2434[x]  ->
DM_CE0849[m] CE0849[m]  ->
DM_CE2433[m] CE2433[m]  ->
DM_CE0849[x] CE0849[x]  ->
DM_CE2433[x] CE2433[x]  ->
DM_CE0785[m] CE0785[m]  ->
DM_CE2432[m] CE2432[m]  ->
DM_CE0785[x] CE0785[x]  ->
DM_CE2432[x] CE2432[x]  ->
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DM_dec24dicoa[x] dec24dicoa[x]  ->
DM_dece4coa[x] dece4coa[x]  ->
DM_C05279[m] C05279[m]  ->
DM_CE2420[m] CE2420[m]  ->
DM_C05279[x] C05279[x]  ->
DM_CE2420[x] CE2420[x]  ->
DM_CE2417[m] CE2417[m]  ->
DM_CE2417[x] CE2417[x]  ->
DM_CE2418[m] CE2418[m]  ->
DM_CE2418[x] CE2418[x]  ->
DM_CE2422[m] CE2422[m]  ->
DM_CE2422[x] CE2422[x]  ->
DM_CE2424[m] CE2424[m]  ->
DM_CE2424[x] CE2424[x]  ->
DM_CE0693[m] CE0693[m]  ->
DM_CE0693[x] CE0693[x]  ->
DM_C05280[m] C05280[m]  ->
DM_C05280[x] C05280[x]  ->
DM_dece4coa[m] dece4coa[m]  ->
DM_C05298[c] C05298[c]  ->
DM_C05301[c] C05301[c]  ->
DM_C05299[c] C05299[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_CE4888[c] CE4888[c]  ->
DM_CE5253[c] CE5253[c]  ->
DM_CE5236[c] CE5236[c]  ->
DM_CE5236[n] CE5236[n]  ->
DM_CE1918[c] CE1918[c]  ->
DM_xol7aone[m] xol7aone[m]  ->
DM_xol27oh[c] xol27oh[c]  ->
DM_CE0233[c] CE0233[c]  ->
DM_CE4990[c] CE4990[c]  ->
DM_CE4990[m] CE4990[m]  ->
DM_CE4990[x] CE4990[x]  ->
DM_cholcoa[m] cholcoa[m]  ->
DM_cholate[m] cholate[m]  ->
DM_cholate[x] cholate[x]  ->
DM_dhcholestancoa[c] dhcholestancoa[c]  ->
DM_CE1589[c] CE1589[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tdechola[c]
Warning: Model already has the same reaction you tried to add: EX_23cump[e]
Warning: Model already has the same reaction you tried to add: EX_3ump[e]

DM_CE5586[c] CE5586[c]  ->
DM_retinal_cis_9[r] retinal_cis_9[r]  ->
DM_CE1617[r] CE1617[r]  ->
DM_retinal_cis_13[r] retinal_cis_13[r]  ->
DM_retinal[r] retinal[r]  ->
DM_CE1617[c] CE1617[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_CE1261[c] CE1261[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_CE5026[c] CE5026[c]  ->
DM_C09642[c] C09642[c]  ->
DM_CE5626[c] CE5626[c]  ->
DM_CE5629[c] CE5629[c]  ->
DM_CE4890[c] CE4890[c]  ->
DM_CE1401[c] CE1401[c]  ->
DM_retinol[r] retinol[r]  ->
DM_pail345p_hs[r] pail345p_hs[r]  ->
DM_C11695[c] C11695[c]  ->
DM_C02712[m] C02712[m]  ->
DM_C02356[c] C02356[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_no2[c] no2[c]  ->
DM_C13856[c] C13856[c]  ->
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DM_prostge2[m] prostge2[m]  ->
DM_HC02203[m] HC02203[m]  ->
DM_C05957[r] C05957[r]  ->
DM_C05957[c] C05957[c]  ->
DM_CE4877[c] CE4877[c]  ->
DM_CE2026[m] CE2026[m]  ->
Warning: Model already has the same reaction you tried to add: sink_dchac[c]

DM_dchac[r] dchac[r]  ->
DM_CE2176[c] CE2176[c]  ->
DM_bgly[c] bgly[c]  ->
DM_CE2934[c] CE2934[c]  ->
DM_CE2172[c] CE2172[c]  ->
DM_C03681[c] C03681[c]  ->
DM_CE2211[c] CE2211[c]  ->
DM_CE5072[c] CE5072[c]  ->
DM_CE1297[c] CE1297[c]  ->
DM_CE1310[m] CE1310[m]  ->
DM_C05300[c] C05300[c]  ->
DM_C05300[r] C05300[r]  ->
Warning: Model already has the same reaction you tried to add: EX_CE5786[e]
Warning: Model already has the same reaction you tried to add: EX_CE5788[e]
Warning: Model already has the same reaction you tried to add: EX_CE5789[e]
Warning: Model already has the same reaction you tried to add: EX_CE5797[e]
Warning: Model already has the same reaction you tried to add: EX_CE5798[e]

DM_CE5276[c] CE5276[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_CE5025[c] CE5025[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE5787[e]
Warning: Model already has the same reaction you tried to add: EX_CE5791[e]

DM_CE5021[c] CE5021[c]  ->
DM_CE5022[c] CE5022[c]  ->
DM_CE2576[c] CE2576[c]  ->
DM_CE2577[c] CE2577[c]  ->
DM_C05302[c] C05302[c]  ->
Warning: Model already has the same reaction you tried to add: sink_avite1[c]

DM_CE1925[c] CE1925[c]  ->
DM_CE5853[c] CE5853[c]  ->
DM_CE1926[c] CE1926[c]  ->
DM_CE5854[c] CE5854[c]  ->
DM_C05109[c] C05109[c]  ->
DM_dsmsterol[c] dsmsterol[c]  ->
DM_ddsmsterol[c] ddsmsterol[c]  ->
DM_CE4968[m] CE4968[m]  ->
DM_CE4970[m] CE4970[m]  ->
DM_CE4969[m] CE4969[m]  ->
Warning: Model already has the same reaction you tried to add: EX_CE5867[e]
Warning: Model already has the same reaction you tried to add: EX_CE5868[e]
Warning: Model already has the same reaction you tried to add: EX_CE5869[e]
Warning: Model already has the same reaction you tried to add: EX_CE4633[e]
Warning: Model already has the same reaction you tried to add: EX_no2[e]
Warning: Model already has the same reaction you tried to add: EX_CE4881[e]

DM_CE5665[c] CE5665[c]  ->
DM_CE5643[c] CE5643[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glcur[e]
Warning: Model already has the same reaction you tried to add: EX_CE1926[e]
Warning: Model already has the same reaction you tried to add: EX_CE5854[e]

DM_CE6205[c] CE6205[c]  ->
DM_CE6252[c] CE6252[c]  ->
DM_C01041[c] C01041[c]  ->
DM_cholcoar[m] cholcoar[m]  ->
DM_CE5166[m] CE5166[m]  ->
DM_CE5166[x] CE5166[x]  ->
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DM_CE4872[c] CE4872[c]  ->
DM_CE4872[m] CE4872[m]  ->
Warning: Model already has the same reaction you tried to add: sink_CE1273[c]

DM_CE1589[r] CE1589[r]  ->
DM_HC02191[r] HC02191[r]  ->
DM_HC02192[x] HC02192[x]  ->
DM_HC02191[x] HC02191[x]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_C02712[c] C02712[c]  ->
DM_CE1556[c] CE1556[c]  ->
Warning: Model already has the same reaction you tried to add: EX_udpgal[e]
Warning: Model already has the same reaction you tried to add: EX_galside_hs[e]
Warning: Model already has the same reaction you tried to add: EX_crm_hs[e]

DM_udpgal[n] udpgal[n]  ->
DM_galside_hs[n] galside_hs[n]  ->
DM_crm_hs[n] crm_hs[n]  ->
DM_udpgal[r] udpgal[r]  ->
DM_galside_hs[r] galside_hs[r]  ->
DM_CE7047[c] CE7047[c]  ->
DM_CE5986[c] CE5986[c]  ->
DM_C01747[l] C01747[l]  ->
DM_C01747[c] C01747[c]  ->
DM_CE5125[x] CE5125[x]  ->
DM_CE5126[x] CE5126[x]  ->
DM_alltn[c] alltn[c]  ->
DM_CE0074[c] CE0074[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE0074[e]

DM_hdcea[m] hdcea[m]  ->
DM_CE0955[r] CE0955[r]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_pail35p_hs[n] pail35p_hs[n]  ->
DM_CE4795[m] CE4795[m]  ->
DM_CE4795[x] CE4795[x]  ->
DM_CE5114[x] CE5114[x]  ->
DM_CE4791[x] CE4791[x]  ->
DM_CE4793[x] CE4793[x]  ->
DM_CE2439[x] CE2439[x]  ->
DM_CE2440[x] CE2440[x]  ->
DM_CE2437[x] CE2437[x]  ->
DM_CE2438[x] CE2438[x]  ->
DM_CE2442[m] CE2442[m]  ->
DM_CE2442[x] CE2442[x]  ->
DM_CE2441[x] CE2441[x]  ->
DM_CE5116[x] CE5116[x]  ->
DM_CE5117[m] CE5117[m]  ->
DM_CE5118[m] CE5118[m]  ->
DM_CE5119[m] CE5119[m]  ->
DM_CE5120[m] CE5120[m]  ->
DM_CE4790[m] CE4790[m]  ->
DM_CE4792[m] CE4792[m]  ->
DM_CE4794[m] CE4794[m]  ->
DM_leuktrB4[m] leuktrB4[m]  ->
DM_leuktrB4[x] leuktrB4[x]  ->
DM_leuktrB4woh[m] leuktrB4woh[m]  ->
DM_CE2053[m] CE2053[m]  ->
DM_CE2053[r] CE2053[r]  ->
DM_leuktrB4wcooh[c] leuktrB4wcooh[c]  ->
DM_CE2053[c] CE2053[c]  ->
DM_leuktrB4wcooh[m] leuktrB4wcooh[m]  ->
DM_leuktrB4woh[c] leuktrB4woh[c]  ->
DM_CE2056[r] CE2056[r]  ->
DM_CE3554[r] CE3554[r]  ->
DM_CE2567[c] CE2567[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
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DM_15HPET[n] 15HPET[n]  ->
DM_h2o2[r] h2o2[r]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_15HPET[r] 15HPET[r]  ->
DM_CE7172[c] CE7172[c]  ->
DM_C06315[c] C06315[c]  ->
DM_C06314[c] C06314[c]  ->
DM_cpppg1[c] cpppg1[c]  ->
DM_C05769[c] C05769[c]  ->
DM_cpppg3[c] cpppg3[c]  ->
DM_C05770[c] C05770[c]  ->
DM_uppg3[c] uppg3[c]  ->
DM_CE2038[x] CE2038[x]  ->
DM_CE5934[x] CE5934[x]  ->
DM_C07297[x] C07297[x]  ->
DM_tmtrdcoa[x] tmtrdcoa[x]  ->
DM_CE4793[c] CE4793[c]  ->
DM_CE5114[c] CE5114[c]  ->
DM_CE4812[c] CE4812[c]  ->
DM_eicostetcoa[r] eicostetcoa[r]  ->
DM_CE2209[c] CE2209[c]  ->
DM_CE4811[c] CE4811[c]  ->
DM_strdnccoa[r] strdnccoa[r]  ->
DM_CE4810[c] CE4810[c]  ->
DM_lnlncacoa[r] lnlncacoa[r]  ->
DM_CE4821[c] CE4821[c]  ->
DM_clpndcoa[r] clpndcoa[r]  ->
DM_CE4819[c] CE4819[c]  ->
DM_tmndnccoa[r] tmndnccoa[r]  ->
DM_CE4817[c] CE4817[c]  ->
DM_tmndnc[r] tmndnc[r]  ->
DM_CE2313[c] CE2313[c]  ->
DM_CE2314[c] CE2314[c]  ->
DM_zymstnl[c] zymstnl[c]  ->
DM_lthstrl[c] lthstrl[c]  ->
DM_tethex3coa[r] tethex3coa[r]  ->
DM_tethex3[r] tethex3[r]  ->
DM_adrncoa[r] adrncoa[r]  ->
DM_CE4833[c] CE4833[c]  ->
DM_CE4831[c] CE4831[c]  ->
DM_CE4835[c] CE4835[c]  ->
DM_CE4834[c] CE4834[c]  ->
DM_CE4849[c] CE4849[c]  ->
DM_CE4820[x] CE4820[x]  ->
DM_CE4832[x] CE4832[x]  ->
DM_CE4838[x] CE4838[x]  ->
DM_tetpent6coa[r] tetpent6coa[r]  ->
DM_tetpent6[r] tetpent6[r]  ->
DM_CE4841[c] CE4841[c]  ->
DM_CE4840[c] CE4840[c]  ->
DM_CE4842[c] CE4842[c]  ->
DM_CE4843[c] CE4843[c]  ->
DM_CE4843[r] CE4843[r]  ->
DM_CE4845[c] CE4845[c]  ->
DM_CE4844[c] CE4844[c]  ->
DM_CE4846[c] CE4846[c]  ->
DM_CE4847[c] CE4847[c]  ->
DM_CE4852[c] CE4852[c]  ->
DM_CE4854[c] CE4854[c]  ->
DM_CE4850[c] CE4850[c]  ->
DM_CE4848[c] CE4848[c]  ->
DM_CE4853[c] CE4853[c]  ->
DM_CE4855[c] CE4855[c]  ->
DM_CE4851[c] CE4851[c]  ->
DM_CE4801[m] CE4801[m]  ->
DM_CE4803[m] CE4803[m]  ->
DM_CE4800[m] CE4800[m]  ->
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DM_CE4796[m] CE4796[m]  ->
DM_CE4802[m] CE4802[m]  ->
DM_CE4804[m] CE4804[m]  ->
DM_CE5049[c] CE5049[c]  ->
DM_CE4806[m] CE4806[m]  ->
DM_CE4798[m] CE4798[m]  ->
DM_CE4799[m] CE4799[m]  ->
DM_CE4808[m] CE4808[m]  ->
DM_CE4807[m] CE4807[m]  ->
DM_CE4797[m] CE4797[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_CE1562[c] CE1562[c]  ->
DM_CE6031[c] CE6031[c]  ->
DM_CE5144[c] CE5144[c]  ->
DM_CE5151[c] CE5151[c]  ->
DM_CE5152[c] CE5152[c]  ->
DM_CE5151[r] CE5151[r]  ->
DM_CE5155[c] CE5155[c]  ->
DM_CE5156[c] CE5156[c]  ->
DM_CE5155[r] CE5155[r]  ->
DM_CE5148[c] CE5148[c]  ->
DM_CE5150[c] CE5150[c]  ->
DM_CE5153[c] CE5153[c]  ->
DM_CE5154[c] CE5154[c]  ->
DM_CE5157[c] CE5157[c]  ->
DM_CE5158[c] CE5158[c]  ->
DM_nrvnccoa[r] nrvnccoa[r]  ->
DM_CE2510[c] CE2510[c]  ->
DM_doco13ac[c] doco13ac[c]  ->
DM_CE5160[c] CE5160[c]  ->
DM_CE5161[c] CE5161[c]  ->
DM_CE5162[c] CE5162[c]  ->
DM_cholcoads[m] cholcoads[m]  ->
DM_CE4874[c] CE4874[c]  ->
DM_CE4874[m] CE4874[m]  ->
DM_C14826[c] C14826[c]  ->
DM_CE2049[c] CE2049[c]  ->
DM_C14825[c] C14825[c]  ->
DM_CE2047[c] CE2047[c]  ->
Warning: Model already has the same reaction you tried to add: EX_cdpea[e]
Warning: Model already has the same reaction you tried to add: EX_12dgr120[e]
DM_C14768[c] C14768[c]  ->
DM_C14770[c] C14770[c]  ->
DM_C14769[c] C14769[c]  ->
DM_C14771[c] C14771[c]  ->
DM_CE2445[c] CE2445[c]  ->
DM_CE5178[c] CE5178[c]  ->
DM_C11821[c] C11821[c]  ->
DM_dmpp[c] dmpp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE1925[e]
Warning: Model already has the same reaction you tried to add: EX_CE5853[e]
DM_C04717[c] C04717[c]  ->
DM_C01601[c] C01601[c]  ->
DM_CE6504[c] CE6504[c]  ->
DM_CE2006[c] CE2006[c]  ->
DM_CE6506[c] CE6506[c]  ->
DM_C08261[c] C08261[c]  ->
DM_CE4876[r] CE4876[r]  ->
DM_CE5304[c] CE5304[c]  ->
DM_CE4876[c] CE4876[c]  ->
DM_CE5944[c] CE5944[c]  ->
DM_CE5944[m] CE5944[m]  ->
DM_CE5944[x] CE5944[x]  ->
DM_CE4987[c] CE4987[c]  ->
DM_CE4988[c] CE4988[c]  ->
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DM_CE4988[m] CE4988[m]  ->
DM_CE4988[x] CE4988[x]  ->
DM_CE4989[c] CE4989[c]  ->
DM_CE5945[c] CE5945[c]  ->
DM_CE5946[c] CE5946[c]  ->
DM_CE5947[c] CE5947[c]  ->
DM_CE7097[c] CE7097[c]  ->
DM_CE7097[m] CE7097[m]  ->
DM_C04805[c] C04805[c]  ->
DM_C04805[r] C04805[r]  ->
DM_CE7096[c] CE7096[c]  ->
DM_CE2084[c] CE2084[c]  ->
DM_C04805[m] C04805[m]  ->
DM_CE2084[m] CE2084[m]  ->
DM_CE6508[c] CE6508[c]  ->
DM_CE7079[c] CE7079[c]  ->
DM_CE7091[c] CE7091[c]  ->
DM_CE7091[r] CE7091[r]  ->
DM_CE7082[c] CE7082[c]  ->
DM_CE7083[c] CE7083[c]  ->
DM_CE7085[c] CE7085[c]  ->
DM_CE7088[c] CE7088[c]  ->
DM_CE7081[r] CE7081[r]  ->
DM_CE7090[c] CE7090[c]  ->
DM_CE0347[c] CE0347[c]  ->
DM_CE0347[r] CE0347[r]  ->
DM_CE6247[c] CE6247[c]  ->
Warning: Model already has the same reaction you tried to add: EX_12HPET[e]
Warning: Model already has the same reaction you tried to add: EX_C04849[e]

DM_leuktrB4wcooh[x] leuktrB4wcooh[x]  ->
DM_CE6230[c] CE6230[c]  ->
DM_CE2537[c] CE2537[c]  ->
DM_CE6232[c] CE6232[c]  ->
DM_CE6234[c] CE6234[c]  ->
DM_CE5947[m] CE5947[m]  ->
DM_CE5947[x] CE5947[x]  ->
DM_dec24dicoa[m] dec24dicoa[m]  ->
DM_dece3coa[m] dece3coa[m]  ->
DM_CE2089[c] CE2089[c]  ->
DM_CE2088[c] CE2088[c]  ->
DM_urcan[c] urcan[c]  ->
DM_C05767[c] C05767[c]  ->
DM_2mb2coa[c] 2mb2coa[c]  ->
DM_3hbcoa_R[c] 3hbcoa_R[c]  ->
DM_adpac[c] adpac[c]  ->
DM_adpcoa[c] adpcoa[c]  ->
DM_adpac[x] adpac[x]  ->
DM_adpcoa[x] adpcoa[x]  ->
DM_c6dc[x] c6dc[x]  ->
DM_3bcrn[c] 3bcrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3bcrn[e]

DM_c10crn[c] c10crn[c]  ->
Warning: Model already has the same reaction you tried to add: sink_c101coa[c]

DM_c101crn[c] c101crn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c101crn[e]
Warning: Model already has the same reaction you tried to add: sink_decdicoa[c]

DM_decdicrn[c] decdicrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c10crn[e]

DM_c10dc[x] c10dc[x]  ->
DM_c10dc[c] c10dc[c]  ->
DM_sebcoa[c] sebcoa[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c10dc[e]

DM_3hdcoa[c] 3hdcoa[c]  ->
DM_3deccrn[c] 3deccrn[c]  ->
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DM_ddeccrn[c] ddeccrn[c]  ->
Warning: Model already has the same reaction you tried to add: sink_dd2coa[c]

DM_ddece1crn[c] ddece1crn[c]  ->
DM_c12dccoa[x] c12dccoa[x]  ->
DM_dodecanac[x] dodecanac[x]  ->
DM_c12dccoa[c] c12dccoa[c]  ->
DM_dodecanac[c] dodecanac[c]  ->
DM_c12dc[c] c12dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c12dc[e]

DM_3hddcoa[c] 3hddcoa[c]  ->
DM_3ddcrn[c] 3ddcrn[c]  ->
DM_3tetd7ecoa[m] 3tetd7ecoa[m]  ->
DM_3tetd7ecoa[c] 3tetd7ecoa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tetdece1coa[c]

DM_tetdece1crn[c] tetdece1crn[c]  ->
DM_3tetd7ecoacrn[c] 3tetd7ecoacrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3tetd7ecoacrn[e]

DM_3ttetddcoa[m] 3ttetddcoa[m]  ->
DM_3ttetddcoa[c] 3ttetddcoa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_tetdec2coa[c]

DM_tetdec2crn[c] tetdec2crn[c]  ->
DM_3ttetddcoacrn[c] 3ttetddcoacrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3ttetddcoacrn[e]

DM_3htdcoa[c] 3htdcoa[c]  ->
DM_3tdcrn[c] 3tdcrn[c]  ->
DM_3hdeccoa[c] 3hdeccoa[c]  ->
DM_3hdececrn[c] 3hdececrn[c]  ->
DM_3thexddcoa[m] 3thexddcoa[m]  ->
DM_3thexddcoa[c] 3thexddcoa[c]  ->
DM_3thexddcoacrn[c] 3thexddcoacrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3thexddcoacrn[e]

DM_hexdicoa[c] hexdicoa[c]  ->
DM_c16dc[c] c16dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c16dc[e]

DM_3hexdcoa[c] 3hexdcoa[c]  ->
DM_3hexdcrn[c] 3hexdcrn[c]  ->
DM_3octdece1coa[c] 3octdece1coa[c]  ->
DM_3octdece1crn[c] 3octdece1crn[c]  ->
DM_3ocddcoa[c] 3ocddcoa[c]  ->
DM_3octdec2crn[c] 3octdec2crn[c]  ->
DM_3hodcoa[c] 3hodcoa[c]  ->
DM_3octdeccrn[c] 3octdeccrn[c]  ->
DM_c3dc[c] c3dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c3dc[e]
Warning: Model already has the same reaction you tried to add: EX_c4crn[e]

DM_c4dc[x] c4dc[x]  ->
DM_c4dc[c] c4dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c4dc[e]

DM_c4crn[x] c4crn[x]  ->
DM_btcoa[x] btcoa[x]  ->
DM_ivcoa[c] ivcoa[c]  ->
DM_ivcrn[c] ivcrn[c]  ->
DM_c51crn[c] c51crn[c]  ->
DM_c5dc[c] c5dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c5dc[e]

DM_hxcoa[c] hxcoa[c]  ->
DM_c6crn[c] c6crn[c]  ->
DM_hxcoa[x] hxcoa[x]  ->
DM_c6crn[x] c6crn[x]  ->
Warning: Model already has the same reaction you tried to add: EX_c6crn[e]

DM_c6dc[c] c6dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c6dc[e]
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Warning: Model already has the same reaction you tried to add: sink_c81coa[c]
DM_c81crn[c] c81crn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c81crn[e]
Warning: Model already has the same reaction you tried to add: EX_c8crn[e]
DM_sbcoa[c] sbcoa[c]  ->
DM_c8dc[c] c8dc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_c8dc[e]
DM_dca[r] dca[r]  ->
Warning: Model already has the same reaction you tried to add: EX_3ddcrn[e]
Warning: Model already has the same reaction you tried to add: EX_ddecrn[e]
Warning: Model already has the same reaction you tried to add: EX_ddece1crn[e]
Warning: Model already has the same reaction you tried to add: EX_3deccrn[e]
Warning: Model already has the same reaction you tried to add: EX_decdicrn[e]
Warning: Model already has the same reaction you tried to add: sink_doco13ecoa[c]
DM_doco13ecoa[x] doco13ecoa[x]  ->
Warning: Model already has the same reaction you tried to add: EX_doco13ac[e]
Warning: Model already has the same reaction you tried to add: EX_docosac[e]
DM_docosac[r] docosac[r]  ->
DM_docosdiac[r] docosdiac[r]  ->
DM_docosdiac[c] docosdiac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_docosdiac[e]
Warning: Model already has the same reaction you tried to add: EX_3hdececrn[e]
Warning: Model already has the same reaction you tried to add: EX_3hexdcrn[e]
Warning: Model already has the same reaction you tried to add: EX_3ivcrn[e]
Warning: Model already has the same reaction you tried to add: EX_3octdec2crn[e]
Warning: Model already has the same reaction you tried to add: EX_3octdeccrn[e]
Warning: Model already has the same reaction you tried to add: EX_3octdece1crn[e]
Warning: Model already has the same reaction you tried to add: EX_3tdcrn[e]
Warning: Model already has the same reaction you tried to add: EX_c51crn[e]
Warning: Model already has the same reaction you tried to add: EX_ivcrn[e]
Warning: Model already has the same reaction you tried to add: EX_tetdec2crn[e]
Warning: Model already has the same reaction you tried to add: EX_tetdece1crn[e]
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DM_dece3coa[x] dece3coa[x]  ->
DM_dec47dicoa[m] dec47dicoa[m]  ->
DM_dectricoa[m] dectricoa[m]  ->
DM_dec47dicoa[x] dec47dicoa[x]  ->
DM_dectricoa[x] dectricoa[x]  ->
DM_2decdicoa[m] 2decdicoa[m]  ->
DM_octe5coa[m] octe5coa[m]  ->
DM_2decdicoa[x] 2decdicoa[x]  ->
DM_octe5coa[x] octe5coa[x]  ->
DM_3decdicoa[m] 3decdicoa[m]  ->
DM_3decdicoa[x] 3decdicoa[x]  ->
DM_sebcoa[x] sebcoa[x]  ->
DM_sbcoa[x] sbcoa[x]  ->
DM_tmuncoa[x] tmuncoa[x]  ->
DM_undcoa[m] undcoa[m]  ->
DM_noncoa[m] noncoa[m]  ->
DM_dd5ecoa[m] dd5ecoa[m]  ->
DM_dd3coa[x] dd3coa[x]  ->
DM_2ddecdicoa[m] 2ddecdicoa[m]  ->
DM_3ddecdicoa[m] 3ddecdicoa[m]  ->
DM_2ddecdicoa[x] 2ddecdicoa[x]  ->
DM_3ddecdicoa[x] 3ddecdicoa[x]  ->
DM_2dodtricoa[m] 2dodtricoa[m]  ->
DM_2dodtricoa[x] 2dodtricoa[x]  ->
DM_3dodtricoa[m] 3dodtricoa[m]  ->
DM_3dodtricoa[x] 3dodtricoa[x]  ->
DM_c12dc[x] c12dc[x]  ->
DM_tridcoa[m] tridcoa[m]  ->
DM_tetd7ecoa[m] tetd7ecoa[m]  ->
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DM_tetde5coa[x] tetde5coa[x]  ->
DM_tetdecdicoa[m] tetdecdicoa[m]  ->
DM_tetdecdicoa[x] tetdecdicoa[x]  ->
DM_ttetddcoa[m] ttetddcoa[m]  ->
DM_5tedtricoa[m] 5tedtricoa[m]  ->
DM_5tedtricoa[x] 5tedtricoa[x]  ->
DM_c14dccoa[x] c14dccoa[x]  ->
DM_hexde7coa[x] hexde7coa[x]  ->
DM_3hdeccoa[m] 3hdeccoa[m]  ->
DM_hexddcoa[m] hexddcoa[m]  ->
DM_thexddcoa[m] thexddcoa[m]  ->
DM_2hexdtricoa[x] 2hexdtricoa[x]  ->
DM_hexdtrcoa[m] hexdtrcoa[m]  ->
DM_4hexdtricoa[m] 4hexdtricoa[m]  ->
DM_hexdectecoa[m] hexdectecoa[m]  ->
DM_4hexdtricoa[x] 4hexdtricoa[x]  ->
DM_hexdectecoa[x] hexdectecoa[x]  ->
DM_2hexdtricoa[m] 2hexdtricoa[m]  ->
DM_3hexdtricoa[m] 3hexdtricoa[m]  ->
DM_3hexdtricoa[x] 3hexdtricoa[x]  ->
DM_2hexdtetcoa[m] 2hexdtetcoa[m]  ->
DM_2hexdtetcoa[x] 2hexdtetcoa[x]  ->
DM_4hexdtetcoa[m] 4hexdtetcoa[m]  ->
DM_hexdpencoa[m] hexdpencoa[m]  ->
DM_4hexdtetcoa[x] 4hexdtetcoa[x]  ->
DM_hexdpencoa[x] hexdpencoa[x]  ->
DM_3hexdtetcoa[m] 3hexdtetcoa[m]  ->
DM_3hexdtetcoa[x] 3hexdtetcoa[x]  ->
DM_3hexdcoa[m] 3hexdcoa[m]  ->
DM_hexdicoa[x] hexdicoa[x]  ->
DM_hexdicoa[r] hexdicoa[r]  ->
DM_hexdiac[r] hexdiac[r]  ->
DM_whhdca[r] whhdca[r]  ->
DM_ocde9ecoa[x] ocde9ecoa[x]  ->
DM_3octdece1coa[m] 3octdece1coa[m]  ->
DM_octdececoa[m] octdececoa[m]  ->
DM_3ocddcoa[m] 3ocddcoa[m]  ->
DM_2octdectecoa[m] 2octdectecoa[m]  ->
DM_2octdectecoa[x] 2octdectecoa[x]  ->
DM_3octdectecoa[m] 3octdectecoa[m]  ->
DM_3octdectecoa[x] 3octdectecoa[x]  ->
DM_2octpencoa[m] 2octpencoa[m]  ->
DM_3octpencoa[m] 3octpencoa[m]  ->
DM_3hodcoa[m] 3hodcoa[m]  ->
DM_ei11ecoa[x] ei11ecoa[x]  ->
DM_eitetcoa[m] eitetcoa[m]  ->
DM_eitetcoa[x] eitetcoa[x]  ->
DM_eipencoa[x] eipencoa[x]  ->
DM_5eipencoa[m] 5eipencoa[m]  ->
DM_2docopencoa[m] 2docopencoa[m]  ->
DM_2docopencoa[x] 2docopencoa[x]  ->
DM_docohexcoa[m] docohexcoa[m]  ->
DM_docohexcoa[x] docohexcoa[x]  ->
DM_3docopencoa[m] 3docopencoa[m]  ->
DM_3docopencoa[x] 3docopencoa[x]  ->
DM_2docohexecoa[m] 2docohexecoa[m]  ->
DM_docohepcoa[m] docohepcoa[m]  ->
DM_docosahexcoa[m] docosahexcoa[m]  ->
DM_omhdocosac[r] omhdocosac[r]  ->
DM_succoa[c] succoa[c]  ->
DM_pentcoa[m] pentcoa[m]  ->
DM_glutcoa[c] glutcoa[c]  ->
DM_3ivcoa[m] 3ivcoa[m]  ->
DM_3ivcrn[c] 3ivcrn[c]  ->
DM_3ivcoa[c] 3ivcoa[c]  ->
DM_hx2coa[x] hx2coa[x]  ->
DM_hexe3coa[m] hexe3coa[m]  ->
DM_hexe3coa[x] hexe3coa[x]  ->
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DM_succoa[x] succoa[x]  ->
DM_hepcoa[m] hepcoa[m]  ->
DM_omhdecacid[r] omhdecacid[r]  ->
DM_hexdiac[c] hexdiac[c]  ->
DM_omhdocosac[c] omhdocosac[c]  ->
DM_omhdecacid[c] omhdecacid[c]  ->
DM_sebacid[c] sebacid[c]  ->
DM_tdec4ecoa[m] tdec4ecoa[m]  ->
DM_ctdecdcoa[m] ctdecdcoa[m]  ->
DM_tddedi2coa[m] tddedi2coa[m]  ->
DM_tddedicoa[m] tddedicoa[m]  ->
DM_ocdececrn[c] ocdececrn[c]  ->
DM_ocdececrn[m] ocdececrn[m]  ->
DM_octdececrn[c] octdececrn[c]  ->
DM_octdececrn[m] octdececrn[m]  ->
Warning: Model already has the same reaction you tried to add: sink_octdececoa[c]

DM_subeac[x] subeac[x]  ->
DM_sebacid[x] sebacid[x]  ->
DM_subeac[c] subeac[c]  ->
DM_c8dc[x] c8dc[x]  ->
Warning: Model already has the same reaction you tried to add: EX_ttdcrn[e]
Warning: Model already has the same reaction you tried to add: EX_4hpro[e]

DM_alaala[c] alaala[c]  ->
Warning: Model already has the same reaction you tried to add: EX_alaala[e]
Warning: Model already has the same reaction you tried to add: EX_bglc[e]
Warning: Model already has the same reaction you tried to add: EX_glgchlo[e]
Warning: Model already has the same reaction you tried to add: EX_gltcho[e]
Warning: Model already has the same reaction you tried to add: EX_tdechola[e]
Warning: Model already has the same reaction you tried to add: EX_gltdechol[e]
Warning: Model already has the same reaction you tried to add: EX_carn[e]

DM_glygly[c] glygly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glygly[e]
Warning: Model already has the same reaction you tried to add: EX_glyphe[e]

DM_glyphe[c] glyphe[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glypro[e]

DM_glypro[c] glypro[c]  ->
DM_glysar[c] glysar[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glysar[e]
Warning: Model already has the same reaction you tried to add: EX_dchac[e]
Warning: Model already has the same reaction you tried to add: EX_gum[e]
Warning: Model already has the same reaction you tried to add: EX_gumdchac[e]
Warning: Model already has the same reaction you tried to add: EX_gumgchol[e]
Warning: Model already has the same reaction you tried to add: EX_gumtchol[e]
Warning: Model already has the same reaction you tried to add: DM_5hpet[r]
Warning: Model already has the same reaction you tried to add: EX_leugly[e]

DM_leugly[c] leugly[c]  ->
DM_leuleu[c] leuleu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_leuleu[e]
Warning: Model already has the same reaction you tried to add: EX_pect[e]
Warning: Model already has the same reaction you tried to add: EX_pectindchac[e]
Warning: Model already has the same reaction you tried to add: EX_pectingchol[e]
Warning: Model already has the same reaction you tried to add: EX_pectintchol[e]
Warning: Model already has the same reaction you tried to add: EX_progly[e]

DM_progly[c] progly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_psyl[e]
Warning: Model already has the same reaction you tried to add: EX_psylchol[e]
Warning: Model already has the same reaction you tried to add: EX_psyltchol[e]
Warning: Model already has the same reaction you tried to add: EX_psyltdechol[e]
Warning: Model already has the same reaction you tried to add: EX_sbt_D[e]
Warning: Model already has the same reaction you tried to add: EX_thm[e]
```

```
DM_1a25dhvitd3[c] 1a25dhvitd3[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_1a25dhvitd3[n] 1a25dhvitd3[n]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_4abut[n] 4abut[n]  ->
DM_oh1[c] oh1[c]  ->
Warning: Model already has the same reaction you tried to add: EX_oh1[e]
Warning: Model already has the same reaction you tried to add: EX_hyptaur[e]
Warning: Model already has the same reaction you tried to add: EX_cysam[e]
Warning: Model already has the same reaction you tried to add: EX_q10[e]
DM_dhap[m] dhap[m]  ->
Warning: Model already has the same reaction you tried to add: EX_dpcoa[e]
Warning: Model already has the same reaction you tried to add: EX_pan4p[e]
DM_5dpmev[c] 5dpmev[c]  ->
Warning: Model already has the same reaction you tried to add: EX_sfcys[e]
Warning: Model already has the same reaction you tried to add: EX_fmn[e]
Warning: Model already has the same reaction you tried to add: EX_ptth[e]
Warning: Model already has the same reaction you tried to add: EX_q10h2[e]
Warning: Model already has the same reaction you tried to add: sink_fe3[c]
DM_6pgl[c] 6pgl[c]  ->
DM_glu5sa[c] glu5sa[c]  ->
DM_mal_L[x] mal_L[x]  ->
DM_5pmev[c] 5pmev[c]  ->
DM_1pyr5c[c] 1pyr5c[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pheme[e]
DM_slfcys[c] slfcys[c]  ->
Warning: Model already has the same reaction you tried to add: EX_34hpp[e]
Warning: Model already has the same reaction you tried to add: EX_3mob[e]
Warning: Model already has the same reaction you tried to add: EX_3mop[e]
Warning: Model already has the same reaction you tried to add: EX_4mop[e]
Warning: Model already has the same reaction you tried to add: EX_5mta[e]
Warning: Model already has the same reaction you tried to add: EX_5oxpro[e]
Warning: Model already has the same reaction you tried to add: EX_ahcys[e]
Warning: Model already has the same reaction you tried to add: EX_aicar[e]
Warning: Model already has the same reaction you tried to add: EX_anth[e]
Warning: Model already has the same reaction you tried to add: EX_cbasp[e]
Warning: Model already has the same reaction you tried to add: EX_mal_L[e]
Warning: Model already has the same reaction you tried to add: EX_idour[e]
Warning: Model already has the same reaction you tried to add: EX_5hoxindoa[e]
Warning: Model already has the same reaction you tried to add: EX_glyald[e]
Warning: Model already has the same reaction you tried to add: EX_pep[e]
Warning: Model already has the same reaction you tried to add: EX_gudac[e]
Warning: Model already has the same reaction you tried to add: EX_Lkynr[e]
Warning: Model already has the same reaction you tried to add: EX_cala[e]
Warning: Model already has the same reaction you tried to add: EX_crtn[e]
Warning: Model already has the same reaction you tried to add: EX_kynate[e]
Warning: Model already has the same reaction you tried to add: EX_3hanthrn[e]
Warning: Model already has the same reaction you tried to add: EX_hLkynr[e]
Warning: Model already has the same reaction you tried to add: EX_quln[e]
Warning: Model already has the same reaction you tried to add: EX_2pg[e]
Warning: Model already has the same reaction you tried to add: EX_cholp[e]
Warning: Model already has the same reaction you tried to add: EX_cyst_L[e]
DM_cyst_L[c] cyst_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dcmp[e]
Warning: Model already has the same reaction you tried to add: EX_dmgly[e]
Warning: Model already has the same reaction you tried to add: EX_ethamp[e]
Warning: Model already has the same reaction you tried to add: EX_fum[e]
```

```
Warning: Model already has the same reaction you tried to add: EX_g3pc[e]
Warning: Model already has the same reaction you tried to add: EX_icit[e]
Warning: Model already has the same reaction you tried to add: EX_L2aadp[e]
Warning: Model already has the same reaction you tried to add: EX_xan[e]
Warning: Model already has the same reaction you tried to add: EX_xmp[e]
Warning: Model already has the same reaction you tried to add: EX_xtsn[e]
Warning: Model already has the same reaction you tried to add: EX_3pg[e]
Warning: Model already has the same reaction you tried to add: EX_udpglcur[e]
Warning: Model already has the same reaction you tried to add: EX_glyc3p[e]
Warning: Model already has the same reaction you tried to add: EX_nicrnt[e]
Warning: Model already has the same reaction you tried to add: EX_orot5p[e]
Warning: Model already has the same reaction you tried to add: EX_hcys_L[e]
Warning: Model already has the same reaction you tried to add: EX_retinal[e]
Warning: Model already has the same reaction you tried to add: EX_argsuc[e]
Warning: Model already has the same reaction you tried to add: EX_acrn[e]
Warning: Model already has the same reaction you tried to add: EX_pcrn[e]
Warning: Model already has the same reaction you tried to add: EX_lneldccrn[e]
Warning: Model already has the same reaction you tried to add: EX_odecrn[e]
Warning: Model already has the same reaction you tried to add: EX_stcrn[e]
Warning: Model already has the same reaction you tried to add: EX_pmtcrn[e]
Warning: Model already has the same reaction you tried to add: EX_hdcecrn[e]
Warning: Model already has the same reaction you tried to add: EX_pcreat[e]
Warning: Model already has the same reaction you tried to add: EX_HC00342[e]
Warning: Model already has the same reaction you tried to add: EX_bgly[e]
DM_15kprostgf2[c] 15kprostgf2[c]  ->
DM_adpoh[c] adpoh[c]  ->
DM_phlac[c] phlac[c]  ->
DM_and19one[c] and19one[c]  ->
DM_ttdceacoa[c] ttdceacoa[c]  ->
DM_21hprgnlone[c] 21hprgnlone[c]  ->
DM_3mhis[c] 3mhis[c]  ->
DM_hmcr[c] hmcr[c]  ->
DM_phacgly[c] phacgly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pcholmyr_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholole_hs[e]
Warning: Model already has the same reaction you tried to add: EX_peole_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholpalme_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholpalm_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pepalm_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pail_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pailpalm_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholste_hs[e]
Warning: Model already has the same reaction you tried to add: EX_peste_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pailste_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pchol2linl_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe2linl_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pchol2ole_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pchol2palm_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pchol2ste_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xolest183_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xolest181_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xolest205_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xolest204_hs[e]
Warning: Model already has the same reaction you tried to add: EX_xolest226_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn15_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholar_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn183_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn1836_hs[e]
```

```
Warning: Model already has the same reaction you tried to add: EX_pcholn19_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn201_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn204_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn205_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn224_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn225_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn2254_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn226_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pear_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe203_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe226_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe224_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pedh203_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe12_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe14_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe161_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe13_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe15_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pe17_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn203_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pailar_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn24_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn261_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn281_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholn28_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholdoc_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholeic_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholet_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pcholhep_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pchollinl_hs[e]
Warning: Model already has the same reaction you tried to add: EX_pelinl_hs[e]
```

```
DM_sphmyln18114_hs[c] sphmyln18114_hs[c]  ->
DM_sphmyln18121_hs[c] sphmyln18121_hs[c]  ->
DM_sphmyln181221_hs[c] sphmyln181221_hs[c]  ->
DM_sphmyln18122_hs[c] sphmyln18122_hs[c]  ->
DM_sphmyln18123_hs[c] sphmyln18123_hs[c]  ->
DM_sphmyln180241_hs[c] sphmyln180241_hs[c]  ->
DM_sphmyln1824_hs[c] sphmyln1824_hs[c]  ->
DM_sphmyln1825_hs[c] sphmyln1825_hs[c]  ->
DM_sphmyln18115_hs[c] sphmyln18115_hs[c]  ->
DM_sphmyln181161_hs[c] sphmyln181161_hs[c]  ->
DM_sphmyln18116_hs[c] sphmyln18116_hs[c]  ->
DM_sphmyln18117_hs[c] sphmyln18117_hs[c]  ->
DM_sphmyln18118_hs[c] sphmyln18118_hs[c]  ->
DM_sphmyln181181_hs[c] sphmyln181181_hs[c]  ->
DM_sphmyln181201_hs[c] sphmyln181201_hs[c]  ->
DM_sphmyln18120_hs[c] sphmyln18120_hs[c]  ->
DM_xolest183_hs[l] xolest183_hs[l]  ->
DM_xolest182_hs[l] xolest182_hs[l]  ->
DM_tmndnc[l] tmndnc[l]  ->
DM_xolest205_hs[l] xolest205_hs[l]  ->
DM_crvnc[l] crvnc[l]  ->
DM_xolest226_hs[l] xolest226_hs[l]  ->
```

```
Warning: Model already has the same reaction you tried to add: EX_maglinl_hs[e]
Warning: Model already has the same reaction you tried to add: EX_magole_hs[e]
Warning: Model already has the same reaction you tried to add: EX_magpalm_hs[e]
Warning: Model already has the same reaction you tried to add: EX_magste_hs[e]
Warning: Model already has the same reaction you tried to add: EX_magarachi_hs[e]
```

```
DM_pcholmyr_hs[c] pcholmyr_hs[c]  ->
DM_pcholole_hs[c] pcholole_hs[c]  ->
```

```
DM_peole_hs[c] peole_hs[c]  ->
DM_pcholpalme_hs[c] pcholpalme_hs[c]  ->
DM_pcholpalm_hs[c] pcholpalm_hs[c]  ->
DM_pepalm_hs[c] pepalm_hs[c]  ->
DM_pailpalm_hs[c] pailpalm_hs[c]  ->
DM_pcholste_hs[c] pcholste_hs[c]  ->
DM_pchol2linl_hs[c] pchol2linl_hs[c]  ->
DM_pe2linl_hs[c] pe2linl_hs[c]  ->
DM_pchol2ole_hs[c] pchol2ole_hs[c]  ->
DM_pchol2palm_hs[c] pchol2palm_hs[c]  ->
DM_pchol2ste_hs[c] pchol2ste_hs[c]  ->
DM_pcholn15_hs[c] pcholn15_hs[c]  ->
DM_pcholar_hs[c] pcholar_hs[c]  ->
DM_pcholn183_hs[c] pcholn183_hs[c]  ->
DM_pcholn1836_hs[c] pcholn1836_hs[c]  ->
DM_pcholn19_hs[c] pcholn19_hs[c]  ->
DM_pcholn201_hs[c] pcholn201_hs[c]  ->
DM_pcholn204_hs[c] pcholn204_hs[c]  ->
DM_pcholn205_hs[c] pcholn205_hs[c]  ->
DM_pcholn224_hs[c] pcholn224_hs[c]  ->
DM_pcholn225_hs[c] pcholn225_hs[c]  ->
DM_pcholn2254_hs[c] pcholn2254_hs[c]  ->
DM_pcholn226_hs[c] pcholn226_hs[c]  ->
DM_pear_hs[c] pear_hs[c]  ->
DM_pe203_hs[c] pe203_hs[c]  ->
DM_pe226_hs[c] pe226_hs[c]  ->
DM_pe224_hs[c] pe224_hs[c]  ->
DM_pedh203_hs[c] pedh203_hs[c]  ->
DM_pe12_hs[c] pe12_hs[c]  ->
DM_pe14_hs[c] pe14_hs[c]  ->
DM_pe161_hs[c] pe161_hs[c]  ->
DM_pe13_hs[c] pe13_hs[c]  ->
DM_pe15_hs[c] pe15_hs[c]  ->
DM_pe17_hs[c] pe17_hs[c]  ->
DM_pcholn203_hs[c] pcholn203_hs[c]  ->
DM_pailar_hs[c] pailar_hs[c]  ->
DM_pcholn24_hs[c] pcholn24_hs[c]  ->
DM_pcholn261_hs[c] pcholn261_hs[c]  ->
DM_pcholn281_hs[c] pcholn281_hs[c]  ->
DM_pcholn28_hs[c] pcholn28_hs[c]  ->
DM_pcholdoc_hs[c] pcholdoc_hs[c]  ->
DM_pcholeic_hs[c] pcholeic_hs[c]  ->
DM_pcholet_hs[c] pcholet_hs[c]  ->
DM_pcholhep_hs[c] pcholhep_hs[c]  ->
DM_pchollinl_hs[c] pchollinl_hs[c]  ->
DM_pelinl_hs[c] pelinl_hs[c]  ->
DM_eidi1114ac[c] eidi1114ac[c]  ->
DM_hxa[c] hxa[c]  ->
DM_tetdeca511ac[c] tetdeca511ac[c]  ->
DM_glyc2p[c] glyc2p[c]  ->
DM_aclys[c] aclys[c]  ->
DM_hmcarn[c] hmcarn[c]  ->
DM_4mtob[c] 4mtob[c]  ->
DM_3mtp[c] 3mtp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3mtp[e]
Warning: Model already has the same reaction you tried to add: EX_elaidcrn[e]
Warning: Model already has the same reaction you tried to add: EX_lnlccrn[e]
Warning: Model already has the same reaction you tried to add: EX_phlac[e]
Warning: Model already has the same reaction you tried to add: EX_15HPET[e]
Warning: Model already has the same reaction you tried to add: EX_15kprostgf2[e]
Warning: Model already has the same reaction you tried to add: EX_21hprgnlone[e]
Warning: Model already has the same reaction you tried to add: EX_2oxoadp[e]
DM_34hpl[c] 34hpl[c]  ->
Warning: Model already has the same reaction you tried to add: EX_34hpl[e]
DM_3hmp[c] 3hmp[c]  ->
```

```
Warning: Model already has the same reaction you tried to add: EX_3hmp[e]

DM_3hpppnohgluc[c] 3hpppnohgluc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hpppnohgluc[e]

DM_3hpppn[c] 3hpppn[c]  ->
DM_3hpppnoh[c] 3hpppnoh[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hpp[e]
Warning: Model already has the same reaction you tried to add: EX_3mhis[e]
Warning: Model already has the same reaction you tried to add: EX_3moxtyr[e]
Warning: Model already has the same reaction you tried to add: EX_3uib[e]
Warning: Model already has the same reaction you tried to add: EX_4aabutn[e]
Warning: Model already has the same reaction you tried to add: EX_4tmeabutn[e]
Warning: Model already has the same reaction you tried to add: EX_56dthm[e]
Warning: Model already has the same reaction you tried to add: EX_56dura[e]
Warning: Model already has the same reaction you tried to add: EX_5aop[e]
Warning: Model already has the same reaction you tried to add: EX_5HPET[e]
Warning: Model already has the same reaction you tried to add: EX_7dhchsterol[e]
Warning: Model already has the same reaction you tried to add: EX_abt_D[e]

DM_abt_D[c] abt_D[c]  ->
DM_acglu[c] acglu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acglu[e]

DM_acgly[m] acgly[m]  ->
DM_acgly[c] acgly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acgly[e]
Warning: Model already has the same reaction you tried to add: EX_aclys[e]

DM_aclys[m] aclys[m]  ->
Warning: Model already has the same reaction you tried to add: EX_acorn[e]

DM_acthr_L[m] acthr_L[m]  ->
DM_acthr_L[c] acthr_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acthr_L[e]
Warning: Model already has the same reaction you tried to add: EX_adpac[e]
Warning: Model already has the same reaction you tried to add: EX_adpoh[e]
Warning: Model already has the same reaction you tried to add: EX_alltn[e]
Warning: Model already has the same reaction you tried to add: EX_amet[e]
Warning: Model already has the same reaction you tried to add: EX_and19one[e]
Warning: Model already has the same reaction you tried to add: EX_pa_hs[e]
Warning: Model already has the same reaction you tried to add: EX_aracheth[e]
Warning: Model already has the same reaction you tried to add: EX_biliverd[e]
Warning: Model already has the same reaction you tried to add: EX_C02356[e]
Warning: Model already has the same reaction you tried to add: EX_C02712[e]
Warning: Model already has the same reaction you tried to add: EX_C04717[e]
Warning: Model already has the same reaction you tried to add: EX_C04805[e]
Warning: Model already has the same reaction you tried to add: EX_C05957[e]
Warning: Model already has the same reaction you tried to add: EX_C06314[e]
Warning: Model already has the same reaction you tried to add: EX_C06315[e]
Warning: Model already has the same reaction you tried to add: EX_C11695[e]
Warning: Model already has the same reaction you tried to add: EX_C14768[e]
Warning: Model already has the same reaction you tried to add: EX_C14769[e]
Warning: Model already has the same reaction you tried to add: EX_C14770[e]
Warning: Model already has the same reaction you tried to add: EX_C14771[e]
Warning: Model already has the same reaction you tried to add: EX_C14825[e]
Warning: Model already has the same reaction you tried to add: EX_C14826[e]

DM_CE0955[c] CE0955[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE0955[e]
Warning: Model already has the same reaction you tried to add: EX_CE1243[e]
Warning: Model already has the same reaction you tried to add: EX_CE1273[e]

DM_CE1297[e] CE1297[e]  ->
Warning: Model already has the same reaction you tried to add: EX_CE1557[e]
```

```
Warning: Model already has the same reaction you tried to add: EX_CE2028[e]
Warning: Model already has the same reaction you tried to add: EX_CE2176[e]
Warning: Model already has the same reaction you tried to add: EX_CE2445[e]
Warning: Model already has the same reaction you tried to add: EX_CE2510[e]
Warning: Model already has the same reaction you tried to add: EX_CE2537[e]
Warning: Model already has the same reaction you tried to add: EX_CE4843[e]
Warning: Model already has the same reaction you tried to add: EX_CE5304[e]
Warning: Model already has the same reaction you tried to add: EX_CE6031[e]
Warning: Model already has the same reaction you tried to add: EX_CE6247[e]
Warning: Model already has the same reaction you tried to add: EX_CE7082[e]
Warning: Model already has the same reaction you tried to add: EX_CE7083[e]
Warning: Model already has the same reaction you tried to add: EX_CE7172[e]
DM_cortsn[c] cortsn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_cortsn[e]
Warning: Model already has the same reaction you tried to add: EX_didecaeth[e]
Warning: Model already has the same reaction you tried to add: EX_diholineth[e]
Warning: Model already has the same reaction you tried to add: EX_docohxeth[e]
Warning: Model already has the same reaction you tried to add: EX_docteteth[e]
Warning: Model already has the same reaction you tried to add: EX_dodecanac[e]
Warning: Model already has the same reaction you tried to add: EX_forglu[e]
DM_HC00319[e] HC00319[e]  ->
Warning: Model already has the same reaction you tried to add: EX_HC00900[e]
Warning: Model already has the same reaction you tried to add: EX_hepdeceth[e]
Warning: Model already has the same reaction you tried to add: EX_hexdeceeth[e]
Warning: Model already has the same reaction you tried to add: EX_hexdiac[e]
Warning: Model already has the same reaction you tried to add: EX_hgentis[e]
Warning: Model already has the same reaction you tried to add: EX_hmcarn[e]
Warning: Model already has the same reaction you tried to add: EX_hmcr[e]
Warning: Model already has the same reaction you tried to add: EX_hxcoa[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrB4wcooh[e]
Warning: Model already has the same reaction you tried to add: EX_leuktrB4woh[e]
Warning: Model already has the same reaction you tried to add: EX_lineth[e]
Warning: Model already has the same reaction you tried to add: EX_Lpipecol[e]
Warning: Model already has the same reaction you tried to add: EX_lthstrl[e]
Warning: Model already has the same reaction you tried to add: EX_mev_R[e]
Warning: Model already has the same reaction you tried to add: EX_mi1p_D[e]
Warning: Model already has the same reaction you tried to add: EX_Nacasp[e]
Warning: Model already has the same reaction you tried to add: EX_nwharg[e]
Warning: Model already has the same reaction you tried to add: EX_oleth[e]
Warning: Model already has the same reaction you tried to add: EX_pcollg5hlys[e]
Warning: Model already has the same reaction you tried to add: EX_pendecaeth[e]
Warning: Model already has the same reaction you tried to add: EX_pmeth[e]
Warning: Model already has the same reaction you tried to add: EX_saccrp_L[e]
Warning: Model already has the same reaction you tried to add: EX_sebacid[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln180241_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18114_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18115_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18116_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln181161_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18117_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18118_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln181181_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18120_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln181201_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18121_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln18122_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln181221_hs[e]
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Warning: Model already has the same reaction you tried to add: EX_sphmyln18123_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln1824_hs[e]
Warning: Model already has the same reaction you tried to add: EX_sphmyln1825_hs[e]
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Warning: Model already has the same reaction you tried to add: EX_subeac[e]
Warning: Model already has the same reaction you tried to add: EX_tetdeca511ac[e]
Warning: Model already has the same reaction you tried to add: EX_tetdecaeth[e]
Warning: Model already has the same reaction you tried to add: EX_thrnt[e]
Warning: Model already has the same reaction you tried to add: EX_tmlys[e]
Warning: Model already has the same reaction you tried to add: EX_trideceth[e]
Warning: Model already has the same reaction you tried to add: EX_txb2[e]
Warning: Model already has the same reaction you tried to add: EX_urcan[e]
Warning: Model already has the same reaction you tried to add: EX_xolest182_hs[e]
Warning: Model already has the same reaction you tried to add: EX_galt[e]
Warning: Model already has the same reaction you tried to add: EX_glyc_R[e]
Warning: Model already has the same reaction you tried to add: EX_glyc2p[e]
Warning: Model already has the same reaction you tried to add: EX_glyclt[e]
Warning: Model already has the same reaction you tried to add: EX_3hpppn[e]

DM_hxa[m] hxa[m]  ->
DM_hxa[x] hxa[x]  ->
Warning: Model already has the same reaction you tried to add: EX_ind3ac[e]
Warning: Model already has the same reaction you tried to add: EX_Lcyst[e]

DM_Lpipecol[c] Lpipecol[c]  ->
Warning: Model already has the same reaction you tried to add: EX_oaa[e]
Warning: Model already has the same reaction you tried to add: EX_pac[e]

DM_pser_L[c] pser_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pser_L[e]

DM_saccrp_L[c] saccrp_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ttdcea[e]

DM_txb2[c] txb2[c]  ->
DM_acile_L[m] acile_L[m]  ->
DM_acile_L[c] acile_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acile_L[e]

DM_acleu_L[m] acleu_L[m]  ->
DM_acleu_L[c] acleu_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acleu_L[e]

DM_achom_L[m] achom_L[m]  ->
DM_achom_L[c] achom_L[c]  ->
Warning: Model already has the same reaction you tried to add: EX_achom_L[e]
Warning: Model already has the same reaction you tried to add: EX_phacgly[e]
Warning: Model already has the same reaction you tried to add: EX_estriol[e]
Warning: Model already has the same reaction you tried to add: EX_ddca[e]

DM_hom_L[m] hom_L[m]  ->
DM_urscholcoa[c] urscholcoa[c]  ->
Warning: Model already has the same reaction you tried to add: sink_7klitchol[c]

DM_bz[m] bz[m]  ->
DM_bzcoa[m] bzcoa[m]  ->
DM_bgly[m] bgly[m]  ->
DM_phaccoa[m] phaccoa[m]  ->
DM_pheacgly[m] pheacgly[m]  ->
DM_pheacgly[c] pheacgly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pheacgly[e]

DM_pcresol[c] pcresol[c]  ->
DM_pcs[c] pcs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pcresol[e]
Warning: Model already has the same reaction you tried to add: EX_pcs[e]
Warning: Model already has the same reaction you tried to add: EX_normete_L[e]
Warning: Model already has the same reaction you tried to add: EX_C05300[e]
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Warning: Model already has the same reaction you tried to add: EX_thbpt[e]
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Warning: Model already has the same reaction you tried to add: EX_alaarggly[e]
Warning: Model already has the same reaction you tried to add: EX_alaasnleu[e]
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Warning: Model already has the same reaction you tried to add: EX_argleuphe[e]
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Warning: Model already has the same reaction you tried to add: EX_cysglutrp[e]
Warning: Model already has the same reaction you tried to add: EX_cysleuthr[e]
Warning: Model already has the same reaction you tried to add: EX_cyssermet[e]
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Warning: Model already has the same reaction you tried to add: EX_cystyrasn[e]
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Warning: Model already has the same reaction you tried to add: EX_glntrpglu[e]
Warning: Model already has the same reaction you tried to add: EX_glntyrleu[e]
Warning: Model already has the same reaction you tried to add: EX_gluargleu[e]
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Warning: Model already has the same reaction you tried to add: EX_leuasplys[e]
Warning: Model already has the same reaction you tried to add: EX_leuleutrp[e]
Warning: Model already has the same reaction you tried to add: EX_leupro[e]
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Warning: Model already has the same reaction you tried to add: EX_leuproarg[e]
Warning: Model already has the same reaction you tried to add: EX_leusertrp[e]
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Warning: Model already has the same reaction you tried to add: EX_protrplys[e]
Warning: Model already has the same reaction you tried to add: EX_protrpthr[e]
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Warning: Model already has the same reaction you tried to add: EX_valserarg[e]
Warning: Model already has the same reaction you tried to add: EX_valtrpphe[e]
Warning: Model already has the same reaction you tried to add: EX_valtrpval[e]
Warning: Model already has the same reaction you tried to add: EX_valval[e]
Warning: Model already has the same reaction you tried to add: EX_trpglyasp[e]
```

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DM_alaargcys[c] alaargcys[c]  ->
DM_alaarggly[c] alaarggly[c]  ->
DM_alaasnleu[c] alaasnleu[c]  ->
DM_alaglylys[c] alaglylys[c]  ->
DM_alahisala[c] alahisala[c]  ->
DM_alalysthr[c] alalysthr[c]  ->
DM_argalaala[c] argalaala[c]  ->
DM_argalaphe[c] argalaphe[c]  ->
DM_argalathr[c] argalathr[c]  ->
DM_argarg[c] argarg[c]  ->
DM_argarglys[c] argarglys[c]  ->
DM_argargmet[c] argargmet[c]  ->
DM_argcysgly[c] argcysgly[c]  ->
DM_argcysser[c] argcysser[c]  ->
DM_arggluglu[c] arggluglu[c]  ->
DM_argglupro[c] argglupro[c]  ->
DM_argglygly[c] argglygly[c]  ->
DM_arghisthr[c] arghisthr[c]  ->
DM_argleuphe[c] argleuphe[c]  ->
DM_arglysasp[c] arglysasp[c]  ->
DM_argphearg[c] argphearg[c]  ->
DM_argpromet[c] argpromet[c]  ->
DM_argprothr[c] argprothr[c]  ->
DM_argserser[c] argserser[c]  ->
DM_argtyrval[c] argtyrval[c]  ->
DM_argvalcys[c] argvalcys[c]  ->
DM_argvaltrp[c] argvaltrp[c]  ->
DM_asnasnarg[c] asnasnarg[c]  ->
DM_asncyscys[c] asncyscys[c]  ->
DM_asnmetpro[c] asnmetpro[c]  ->
DM_asnpheasp[c] asnpheasp[c]  ->
DM_asnphecys[c] asnphecys[c]  ->
DM_asntyrgly[c] asntyrgly[c]  ->
DM_asntyrphe[c] asntyrphe[c]  ->
DM_asntyrthr[c] asntyrthr[c]  ->
DM_aspalaarg[c] aspalaarg[c]  ->
DM_aspasnglu[c] aspasnglu[c]  ->
DM_aspglu[c] aspglu[c]  ->
DM_aspglupro[c] aspglupro[c]  ->
DM_aspglutrp[c] aspglutrp[c]  ->
DM_asphiscys[c] asphiscys[c]  ->
DM_asphispro[c] asphispro[c]  ->
DM_asplysglu[c] asplysglu[c]  ->
DM_asplyshis[c] asplyshis[c]  ->
DM_aspmetasp[c] aspmetasp[c]  ->
DM_aspprolys[c] aspprolys[c]  ->
DM_aspvalasn[c] aspvalasn[c]  ->
DM_cysasnmet[c] cysasnmet[c]  ->
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DM_cysaspphe[c] cysaspphe[c] ->
DM_cyscys[c] cyscys[c] ->
DM_cysglnmet[c] cysglnmet[c] ->
DM_cysgluhis[c] cysgluhis[c] ->
DM_cysglutrp[c] cysglutrp[c] ->
DM_cysleuthr[c] cysleuthr[c] ->
DM_cyssermet[c] cyssermet[c] ->
DM_cystyrasn[c] cystyrasn[c] ->
DM_glnasngln[c] glnasngln[c] ->
DM_glnhishis[c] glnhishis[c] ->
DM_glnhislys[c] glnhislys[c] ->
DM_glnlyslys[c] glnlyslys[c] ->
DM_glnlystrp[c] glnlystrp[c] ->
DM_glnproglu[c] glnproglu[c] ->
DM_glntrpglu[c] glntrpglu[c] ->
DM_glntyrleu[c] glntyrleu[c] ->
DM_gluargleu[c] gluargleu[c] ->
DM_gluasnleu[c] gluasnleu[c] ->
DM_gluglu[c] gluglu[c] ->
DM_gluilelys[c] gluilelys[c] ->
DM_gluleu[c] gluleu[c] ->
DM_glumet[c] glumet[c] ->
DM_glumethis[c] glumethis[c] ->
DM_gluthr[c] gluthr[c] ->
DM_gluthrlys[c] gluthrlys[c] ->
DM_glutrpala[c] glutrpala[c] ->
DM_glyhisasn[c] glyhisasn[c] ->
DM_glyhislys[c] glyhislys[c] ->
DM_glylyscys[c] glylyscys[c] ->
DM_glylysphe[c] glylysphe[c] ->
DM_glytyrlys[c] glytyrlys[c] ->
DM_glyvalhis[c] glyvalhis[c] ->
DM_hisargcys[c] hisargcys[c] ->
DM_hisargser[c] hisargser[c] ->
DM_hisasp[c] hisasp[c] ->
DM_hiscyscys[c] hiscyscys[c] ->
DM_hisglnala[c] hisglnala[c] ->
DM_hisglu[c] hisglu[c] ->
DM_hisglugln[c] hisglugln[c] ->
DM_hisglylys[c] hisglylys[c] ->
DM_hishislys[c] hishislys[c] ->
DM_hislysala[c] hislysala[c] ->
DM_hislysglu[c] hislysglu[c] ->
DM_hislysile[c] hislysile[c] ->
DM_hislysthr[c] hislysthr[c] ->
DM_hislysval[c] hislysval[c] ->
DM_hismet[c] hismet[c] ->
DM_hismetgln[c] hismetgln[c] ->
DM_hisphearg[c] hisphearg[c] ->
DM_hisprolys[c] hisprolys[c] ->
DM_histrphis[c] histrphis[c] ->
DM_ileargile[c] ileargile[c] ->
DM_ileasnhis[c] ileasnhis[c] ->
DM_ileasp[c] ileasp[c] ->
DM_ileglnglu[c] ileglnglu[c] ->
DM_ileglyarg[c] ileglyarg[c] ->
DM_ileprolys[c] ileprolys[c] ->
DM_ileserarg[c] ileserarg[c] ->
DM_iletrptyr[c] iletrptyr[c] ->
DM_leualaarg[c] leualaarg[c] ->
DM_leuasnasp[c] leuasnasp[c] ->
DM_leuasplys[c] leuasplys[c] ->
DM_leuleutrp[c] leuleutrp[c] ->
DM_leupro[c] leupro[c] ->
DM_leuproarg[c] leuproarg[c] ->
DM_leusertrp[c] leusertrp[c] ->
DM_leutrp[c] leutrp[c] ->
DM_leutrparg[c] leutrparg[c] ->

DM_leutyrtyr[c] leutyrtyr[c] ->
DM_leuval[c] leuval[c] ->
DM_lysargleu[c] lysargleu[c] ->
DM_lyscyshis[c] lyscyshis[c] ->
DM_lysglnphe[c] lysglnphe[c] ->
DM_lysgluglu[c] lysgluglu[c] ->
DM_lyslyslys[c] lyslyslys[c] ->
DM_lyspheile[c] lyspheile[c] ->
DM_lystrparg[c] lystrparg[c] ->
DM_lystyrile[c] lystyrile[c] ->
DM_lysvalphe[c] lysvalphe[c] ->
DM_lysvaltrp[c] lysvaltrp[c] ->
DM_metargleu[c] metargleu[c] ->
DM_metasntyr[c] metasntyr[c] ->
DM_metglntyr[c] metglntyr[c] ->
DM_metglyarg[c] metglyarg[c] ->
DM_methislys[c] methislys[c] ->
DM_metmetile[c] metmetile[c] ->
DM_metphearg[c] metphearg[c] ->
DM_mettrpphe[c] mettrpphe[c] ->
DM_pheasnmet[c] pheasnmet[c] ->
DM_pheasp[c] pheasp[c] ->
DM_pheglnphe[c] pheglnphe[c] ->
DM_pheleu[c] pheleu[c] ->
DM_pheleuasp[c] pheleuasp[c] ->
DM_pheleuhis[c] pheleuhis[c] ->
DM_phelysala[c] phelysala[c] ->
DM_phelyspro[c] phelyspro[c] ->
DM_phephe[c] phephe[c] ->
DM_phepheasn[c] phepheasn[c] ->
DM_phephethr[c] phephethr[c] ->
DM_pheproarg[c] pheproarg[c] ->
DM_phesertrp[c] phesertrp[c] ->
DM_phethrlys[c] phethrlys[c] ->
DM_phetrpleu[c] phetrpleu[c] ->
DM_phetyr[c] phetyr[c] ->
DM_phetyrgln[c] phetyrgln[c] ->
DM_phetyrlys[c] phetyrlys[c] ->
DM_proargasp[c] proargasp[c] ->
DM_proargcys[c] proargcys[c] ->
DM_proasncys[c] proasncys[c] ->
DM_procys[c] procys[c] ->
DM_proglnpro[c] proglnpro[c] ->
DM_proglulys[c] proglulys[c] ->
DM_prohis[c] prohis[c] ->
DM_prohistyr[c] prohistyr[c] ->
DM_proleuarg[c] proleuarg[c] ->
DM_prolyspro[c] prolyspro[c] ->
DM_prophe[c] prophe[c] ->
DM_proproarg[c] proproarg[c] ->
DM_propropro[c] propropro[c] ->
DM_protrplys[c] protrplys[c] ->
DM_protrpthr[c] protrpthr[c] ->
DM_provalgln[c] provalgln[c] ->
DM_serargala[c] serargala[c] ->
DM_serargtrp[c] serargtrp[c] ->
DM_sercysarg[c] sercysarg[c] ->
DM_serglyglu[c] serglyglu[c] ->
DM_serlyshis[c] serlyshis[c] ->
DM_serphelys[c] serphelys[c] ->
DM_sertrphis[c] sertrphis[c] ->
DM_thrargtyr[c] thrargtyr[c] ->
DM_thrasntyr[c] thrasntyr[c] ->
DM_thrglnglu[c] thrglnglu[c] ->
DM_thrglntyr[c] thrglntyr[c] ->
DM_thrhishis[c] thrhishis[c] ->
DM_thrilearg[c] thrilearg[c] ->
DM_thrmetarg[c] thrmetarg[c] ->

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DM_thrphearg[c] thrphearg[c]  ->
DM_thrserarg[c] thrserarg[c]  ->
DM_thrthrarg[c] thrthrarg[c]  ->
DM_thrtyrmet[c] thrtyrmet[c]  ->
DM_trpalapro[c] trpalapro[c]  ->
DM_trpargala[c] trpargala[c]  ->
DM_trpaspasp[c] trpaspasp[c]  ->
DM_trpglngln[c] trpglngln[c]  ->
DM_trpglugly[c] trpglugly[c]  ->
DM_trpgluleu[c] trpgluleu[c]  ->
DM_trpglupro[c] trpglupro[c]  ->
DM_trpglutyr[c] trpglutyr[c]  ->
DM_trpglyleu[c] trpglyleu[c]  ->
DM_trpglyphe[c] trpglyphe[c]  ->
DM_trpglyval[c] trpglyval[c]  ->
DM_trphismet[c] trphismet[c]  ->
DM_trpilelys[c] trpilelys[c]  ->
DM_trpiletrp[c] trpiletrp[c]  ->
DM_trpleuval[c] trpleuval[c]  ->
DM_trplys[c] trplys[c]  ->
DM_trpmetarg[c] trpmetarg[c]  ->
DM_trpmetval[c] trpmetval[c]  ->
DM_trpphe[c] trpphe[c]  ->
DM_trpprogly[c] trpprogly[c]  ->
DM_trpproleu[c] trpproleu[c]  ->
DM_trpproval[c] trpproval[c]  ->
DM_trpsertyr[c] trpsertyr[c]  ->
DM_trpthrglu[c] trpthrglu[c]  ->
DM_trpthrile[c] trpthrile[c]  ->
DM_trpthrtyr[c] trpthrtyr[c]  ->
DM_trptyrgln[c] trptyrgln[c]  ->
DM_trptyrtyr[c] trptyrtyr[c]  ->
DM_trpvalasp[c] trpvalasp[c]  ->
DM_tyrala[c] tyrala[c]  ->
DM_tyralaphe[c] tyralaphe[c]  ->
DM_tyrargglu[c] tyrargglu[c]  ->
DM_tyrargser[c] tyrargser[c]  ->
DM_tyrasparg[c] tyrasparg[c]  ->
DM_tyrcysgly[c] tyrcysgly[c]  ->
DM_tyrcysthr[c] tyrcysthr[c]  ->
DM_tyrglu[c] tyrglu[c]  ->
DM_tyrleuarg[c] tyrleuarg[c]  ->
DM_tyrphetyr[c] tyrphetyr[c]  ->
DM_tyrthr[c] tyrthr[c]  ->
DM_tyrtrpphe[c] tyrtrpphe[c]  ->
DM_tyrtyr[c] tyrtyr[c]  ->
DM_tyrvalmet[c] tyrvalmet[c]  ->
DM_valarggly[c] valarggly[c]  ->
DM_valhisasn[c] valhisasn[c]  ->
DM_valleuphe[c] valleuphe[c]  ->
DM_vallystyr[c] vallystyr[c]  ->
DM_valphearg[c] valphearg[c]  ->
DM_valprotrp[c] valprotrp[c]  ->
DM_valserarg[c] valserarg[c]  ->
DM_valtrpphe[c] valtrpphe[c]  ->
DM_valtrpval[c] valtrpval[c]  ->
DM_valval[c] valval[c]  ->
DM_trpglyasp[c] trpglyasp[c]  ->
DM_glyleu[c] glyleu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_homoval[e]
DM_xolest183_hs[c] xolest183_hs[c]  ->
DM_xolest182_hs[c] xolest182_hs[c]  ->
DM_xolest205_hs[c] xolest205_hs[c]  ->
DM_xolest226_hs[c] xolest226_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_sphmyln_hs[e]
Warning: Model already has the same reaction you tried to add: EX_hxa[e]
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DM_gncore1[c] gncore1[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gncore1[e]

DM_gncore2[c] gncore2[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gncore2[e]

DM_Lhcystin[c] Lhcystin[c]  ->
Warning: Model already has the same reaction you tried to add: EX_Lhcystin[e]

DM_pglyc_hs[m] pglyc_hs[m]  ->
DM_pgp_hs[m] pgp_hs[m]  ->
Warning: Model already has the same reaction you tried to add: EX_acnam[e]
Warning: Model already has the same reaction you tried to add: sink_band[c]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_bandmt[c] bandmt[c]  ->
DM_dhmtp[c] dhmtp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_etha[e]

DM_ppp9[c] ppp9[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acgal[e]
Warning: Model already has the same reaction you tried to add: EX_core4[e]
Warning: Model already has the same reaction you tried to add: EX_core5[e]
Warning: Model already has the same reaction you tried to add: EX_core7[e]
Warning: Model already has the same reaction you tried to add: EX_core8[e]
Warning: Model already has the same reaction you tried to add: EX_dsT_antigen[e]
Warning: Model already has the same reaction you tried to add: EX_galam[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_galam[c] galam[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mqn10[c] mqn10[c]  ->
Warning: Model already has the same reaction you tried to add: EX_mqn10[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mqn11[c] mqn11[c]  ->
Warning: Model already has the same reaction you tried to add: EX_mqn11[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mqn7[c] mqn7[c]  ->
Warning: Model already has the same reaction you tried to add: EX_mqn7[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mqn9[c] mqn9[c]  ->
Warning: Model already has the same reaction you tried to add: EX_mqn9[e]
Warning: Model already has the same reaction you tried to add: EX_s2l2n2m2m[e]
Warning: Model already has the same reaction you tried to add: EX_sTn_antigen[e]
Warning: Model already has the same reaction you tried to add: EX_f1a[e]
Warning: Model already has the same reaction you tried to add: EX_lpam[e]

DM_lpam[c] lpam[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE2934[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_mqn8[c] mqn8[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dxtrn[e]
Warning: Model already has the same reaction you tried to add: EX_dhcholestanate[e]
Warning: Model already has the same reaction you tried to add: EX_thcholstoic[e]
Warning: Model already has the same reaction you tried to add: EX_xol7ah3[e]
Warning: Model already has the same reaction you tried to add: EX_xol7aone[e]
Warning: Model already has the same reaction you tried to add: EX_xoldiolone[e]
Warning: Model already has the same reaction you tried to add: EX_7klitchol[e]
Warning: Model already has the same reaction you tried to add: EX_2obut[e]

DM_glutar[e] glutar[e]  ->
Warning: Model already has the same reaction you tried to add: EX_glcn[e]

DM_grdp[c] grdp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glyleu[e]
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DM_methf[c] methf[c]  ->
DM_ppbng[c] ppbng[c]  ->
DM_hmbil[c] hmbil[c]  ->
DM_4ppan[c] 4ppan[c]  ->
DM_phom[c] phom[c]  ->
DM_HC01434[c] HC01434[c]  ->
DM_HC01668[c] HC01668[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gua[e]

DM_fprica[c] fprica[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glcr[e]
Warning: Model already has the same reaction you tried to add: EX_hxan[e]
Warning: Model already has the same reaction you tried to add: EX_xyl_D[e]

DM_gal1p[c] gal1p[c]  ->
DM_im4ac[c] im4ac[c]  ->
DM_4izp[c] 4izp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_pydxn[e]
Warning: Model already has the same reaction you tried to add: EX_pydx[e]
Warning: Model already has the same reaction you tried to add: EX_pydam[e]
Warning: Model already has the same reaction you tried to add: EX_4hbz[e]
Warning: Model already has the same reaction you tried to add: EX_34dhpha[e]
Warning: Model already has the same reaction you tried to add: EX_etoh[e]
Warning: Model already has the same reaction you tried to add: EX_acald[e]
Warning: Model already has the same reaction you tried to add: EX_mqn8[e]
Warning: Model already has the same reaction you tried to add: EX_phpyr[e]
Warning: Model already has the same reaction you tried to add: EX_tym[e]
Warning: Model already has the same reaction you tried to add: EX_2hyoxplac[e]
Warning: Model already has the same reaction you tried to add: EX_lanost[e]
Warning: Model already has the same reaction you tried to add: EX_3mox4hoxm[e]
Warning: Model already has the same reaction you tried to add: EX_glx[e]

DM_CE4970[c] CE4970[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE4970[e]

DM_CE2026[c] CE2026[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE2026[e]

DM_CE4968[c] CE4968[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE4968[e]

DM_actyr[m] actyr[m]  ->
DM_actyr[c] actyr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_actyr[e]

DM_sucacetat[c] sucacetat[c]  ->
DM_sucaceto[c] sucaceto[c]  ->
Warning: Model already has the same reaction you tried to add: EX_sucaceto[e]

DM_vanilpyr[c] vanilpyr[c]  ->
DM_vanillac[c] vanillac[c]  ->
DM_CE2176[m] CE2176[m]  ->
DM_nacvanala[m] nacvanala[m]  ->
DM_nacvanala[c] nacvanala[c]  ->
Warning: Model already has the same reaction you tried to add: EX_nacvanala[e]
Warning: Model already has the same reaction you tried to add: EX_vanillac[e]

DM_2h3mv[c] 2h3mv[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2h3mv[e]

DM_2hiv[c] 2hiv[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2hiv[e]

DM_2m3hbu[m] 2m3hbu[m]  ->
DM_2m3hbu[c] 2m3hbu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2m3hbu[e]

DM_2m3ovcoa[m] 2m3ovcoa[m]  ->
DM_2m3ovac[m] 2m3ovac[m]  ->
DM_2m3ovac[c] 2m3ovac[c]  ->
DM_2m3hvac[c] 2m3hvac[c]  ->
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Warning: Model already has the same reaction you tried to add: EX_2m3hvac[e]

DM_3h3mglt[c] 3h3mglt[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3h3mglt[e]

DM_3mglutac[m] 3mglutac[m]  ->
DM_3mglutac[c] 3mglutac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3mglutac[e]

DM_3mglutr[c] 3mglutr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3mglutr[e]

DM_ppiogly[m] ppiogly[m]  ->
DM_ppiogly[c] ppiogly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ppiogly[e]

DM_mvlac[c] mvlac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_mvlac[e]

DM_tiggly[m] tiggly[m]  ->
DM_tiggly[c] tiggly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_tiggly[e]

DM_td2glutrcoa[m] td2glutrcoa[m]  ->
DM_3hglutcoa[m] 3hglutcoa[m]  ->
DM_3ohglutac[m] 3ohglutac[m]  ->
DM_3ohglutac[c] 3ohglutac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3ohglutac[e]

DM_glutacoa[m] glutacoa[m]  ->
DM_glutcon[m] glutcon[m]  ->
DM_glutcon[c] glutcon[c]  ->
Warning: Model already has the same reaction you tried to add: EX_glutcon[e]

DM_3hivac[m] 3hivac[m]  ->
DM_3hivac[c] 3hivac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hivac[e]

DM_3hadicoa[x] 3hadicoa[x]  ->
DM_3hadpac[x] 3hadpac[x]  ->
DM_3hadpac[c] 3hadpac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hadpac[e]

DM_3ohsebcoa[x] 3ohsebcoa[x]  ->
DM_3ohsebac[x] 3ohsebac[x]  ->
DM_3ohsebac[c] 3ohsebac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3ohsebac[e]

DM_3ohsubcoa[x] 3ohsubcoa[x]  ->
DM_3ohsubac[x] 3ohsubac[x]  ->
DM_3ohsubac[c] 3ohsubac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3ohsubac[e]

DM_caproic[c] caproic[c]  ->
DM_5ohhexa[c] 5ohhexa[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5ohhexa[e]

DM_7ohocata[c] 7ohocata[c]  ->
Warning: Model already has the same reaction you tried to add: EX_7ohocata[e]

DM_ethmalcoa[c] ethmalcoa[c]  ->
DM_ethmalac[c] ethmalac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ethmalac[e]

DM_hexgly[c] hexgly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_hexgly[e]

DM_methsuccoa[c] methsuccoa[c]  ->
DM_methsucc[c] methsucc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_methsucc[e]

DM_subgly[c] subgly[c]  ->
Warning: Model already has the same reaction you tried to add: EX_subgly[e]

DM_4ohbut[m] 4ohbut[m]  ->
DM_4ohbut[c] 4ohbut[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4ohbut[e]
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DM_peste_hs[c] peste_hs[c]  ->
DM_2hydog[c] 2hydog[c]  ->
DM_2hydog[e] 2hydog[e]  ->
DM_glutar[c] glutar[c]  ->
DM_thexdd[m] thexdd[m]  ->
DM_thexdd[c] thexdd[c]  ->
Warning: Model already has the same reaction you tried to add: EX_thexdd[e]

DM_hexdtr[m] hexdtr[m]  ->
DM_hexdtr[c] hexdtr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_hexdtr[e]

DM_hpdececoa[m] hpdececoa[m]  ->
DM_hpdece[m] hpdece[m]  ->
DM_hpdece[c] hpdece[c]  ->
Warning: Model already has the same reaction you tried to add: EX_hpdece[e]

DM_eic21114tr[c] eic21114tr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_eic21114tr[e]

DM_5eipenc[m] 5eipenc[m]  ->
DM_5eipenc[c] 5eipenc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5eipenc[e]
Warning: Model already has the same reaction you tried to add: EX_T4hcinnm[e]

DM_agm[c] agm[c]  ->
Warning: Model already has the same reaction you tried to add: EX_agm[e]
Warning: Model already has the same reaction you tried to add: EX_andrstndn[e]

DM_eandrstrn[c] eandrstrn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_eandrstrn[e]

DM_ahandrostan[c] ahandrostan[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ahandrostan[e]

DM_andrstandn[c] andrstandn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_andrstandn[e]
Warning: Model already has the same reaction you tried to add: EX_CE2209[e]
Warning: Model already has the same reaction you tried to add: EX_C05301[e]
Warning: Model already has the same reaction you tried to add: EX_C05299[e]
Warning: Model already has the same reaction you tried to add: EX_C05302[e]
Warning: Model already has the same reaction you tried to add: EX_CE5072[e]
Warning: Model already has the same reaction you tried to add: EX_11docrtsl[e]
Warning: Model already has the same reaction you tried to add: EX_11docrtstrn[e]
Warning: Model already has the same reaction you tried to add: EX_prgnlone[e]
Warning: Model already has the same reaction you tried to add: EX_CE2211[e]
Warning: Model already has the same reaction you tried to add: EX_17ahprgstrn[e]
Warning: Model already has the same reaction you tried to add: EX_17ahprgnlone[e]
Warning: Model already has the same reaction you tried to add: EX_C03681[e]
Warning: Model already has the same reaction you tried to add: EX_prgnlones[e]
Warning: Model already has the same reaction you tried to add: EX_CE1352[e]
Warning: Model already has the same reaction you tried to add: EX_mma[e]
Warning: Model already has the same reaction you tried to add: EX_C05769[e]
Warning: Model already has the same reaction you tried to add: EX_mhista[e]
Warning: Model already has the same reaction you tried to add: EX_CE2006[e]
Warning: Model already has the same reaction you tried to add: EX_n8aspmd[e]
Warning: Model already has the same reaction you tried to add: EX_CE4890[e]
Warning: Model already has the same reaction you tried to add: EX_C09642[e]
Warning: Model already has the same reaction you tried to add: EX_ppp9[e]
Warning: Model already has the same reaction you tried to add: EX_mlthf[e]
Warning: Model already has the same reaction you tried to add: EX_trypta[e]

DM_selmeth[e] selmeth[e]  ->
Warning: Model already has the same reaction you tried to add: EX_CE7090[e]
Warning: Model already has the same reaction you tried to add: EX_CE7085[e]
Warning: Model already has the same reaction you tried to add: EX_CE7096[e]
Warning: Model already has the same reaction you tried to add: EX_CE4877[e]
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DM_CE1447[c] CE1447[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE1447[e]
Warning: Model already has the same reaction you tried to add: EX_C05770[e]
Warning: Model already has the same reaction you tried to add: EX_CE2705[e]
Warning: Model already has the same reaction you tried to add: EX_13dampp[e]
Warning: Model already has the same reaction you tried to add: EX_hdd2crn[e]
Warning: Model already has the same reaction you tried to add: EX_N1aspmd[e]
Warning: Model already has the same reaction you tried to add: EX_CE1918[e]
Warning: Model already has the same reaction you tried to add: EX_34dhoxmand[e]
Warning: Model already has the same reaction you tried to add: EX_CE6205[e]
Warning: Model already has the same reaction you tried to add: EX_1a25dhvitd3[e]
DM_CE4969[c] CE4969[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE4969[e]
DM_CE1310[c] CE1310[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE1310[e]
DM_4hbz[c] 4hbz[c]  ->
DM_sucsal[c] sucsal[c]  ->
Warning: Model already has the same reaction you tried to add: EX_sucsal[e]
DM_CE7081[c] CE7081[c]  ->
Warning: Model already has the same reaction you tried to add: EX_CE7081[e]
DM_egme[c] egme[c]  ->
Warning: Model already has the same reaction you tried to add: EX_egme[e]
DM_12harachd[c] 12harachd[c]  ->
Warning: Model already has the same reaction you tried to add: EX_12harachd[e]
DM_18harachd[c] 18harachd[c]  ->
Warning: Model already has the same reaction you tried to add: EX_18harachd[e]
DM_sql[c] sql[c]  ->
Warning: Model already has the same reaction you tried to add: EX_sql[e]
DM_orn_D[c] orn_D[c]  ->
Warning: Model already has the same reaction you tried to add: EX_orn_D[e]
DM_5g2oxpt[c] 5g2oxpt[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5g2oxpt[e]
Warning: Model already has the same reaction you tried to add: EX_dhea[e]
Warning: Model already has the same reaction you tried to add: EX_estrone[e]
Warning: Model already has the same reaction you tried to add: EX_C05298[e]
DM_HC02020[c] HC02020[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC02020[e]
DM_xol24oh[c] xol24oh[c]  ->
Warning: Model already has the same reaction you tried to add: EX_xol24oh[e]
Warning: Model already has the same reaction you tried to add: EX_xol27oh[e]
DM_xol25oh[c] xol25oh[c]  ->
Warning: Model already has the same reaction you tried to add: EX_xol25oh[e]
Warning: Model already has the same reaction you tried to add: EX_dsmsterol[e]
Warning: Model already has the same reaction you tried to add: EX_chsterols[e]
Warning: Model already has the same reaction you tried to add: EX_3ityr_L[e]
Warning: Model already has the same reaction you tried to add: EX_35diotyr[e]
Warning: Model already has the same reaction you tried to add: EX_13_cis_retn[e]
Warning: Model already has the same reaction you tried to add: EX_CE1617[e]
Warning: Model already has the same reaction you tried to add: EX_HC00005[e]
Warning: Model already has the same reaction you tried to add: EX_HC00006[e]
Warning: Model already has the same reaction you tried to add: EX_HC00007[e]
Warning: Model already has the same reaction you tried to add: EX_HC00008[e]
Warning: Model already has the same reaction you tried to add: EX_HC00009[e]
Warning: Model already has the same reaction you tried to add: EX_idl_hs[e]
Warning: Model already has the same reaction you tried to add: EX_ldl_hs[e]
Warning: Model already has the same reaction you tried to add: EX_hdl_hs[e]
```

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Warning: Reaction with the same name already exists in the model, updating the reaction
DM_myelin_hs[c] myelin_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_HC00460[e]
Warning: Model already has the same reaction you tried to add: EX_fna5moxam[e]
Warning: Model already has the same reaction you tried to add: EX_CE5643[e]
Warning: Model already has the same reaction you tried to add: EX_CE1401[e]
Warning: Model already has the same reaction you tried to add: EX_glucys[e]
Warning: Model already has the same reaction you tried to add: EX_melatn[e]
Warning: Model already has the same reaction you tried to add: EX_6hoxmelatn[e]
Warning: Model already has the same reaction you tried to add: EX_C10164[e]
Warning: Model already has the same reaction you tried to add: EX_C05767[e]
Warning: Model already has the same reaction you tried to add: EX_ppbng[e]
Warning: Model already has the same reaction you tried to add: EX_12ppd_R[e]
Warning: Model already has the same reaction you tried to add: EX_ametam[e]
Warning: Model already has the same reaction you tried to add: EX_xylu_L[e]
Warning: Model already has the same reaction you tried to add: EX_xylu_D[e]
Warning: Model already has the same reaction you tried to add: EX_CE0737[e]
Warning: Model already has the same reaction you tried to add: EX_sphings[e]
Warning: Model already has the same reaction you tried to add: EX_im4ac[e]
Warning: Model already has the same reaction you tried to add: EX_aact[e]
Warning: Model already has the same reaction you tried to add: EX_sphgn[e]
Warning: Model already has the same reaction you tried to add: EX_C13856[e]
Warning: Model already has the same reaction you tried to add: EX_prist[e]
Warning: Model already has the same reaction you tried to add: EX_CE2049[e]
Warning: Model already has the same reaction you tried to add: EX_CE2047[e]
Warning: Model already has the same reaction you tried to add: EX_fdp[e]
Warning: Model already has the same reaction you tried to add: EX_coke[e]
DM_coke[c] coke[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5a2opntn[e]
DM_5a2opntn[c] 5a2opntn[c]  ->
DM_arg_D[c] arg_D[c]  ->
Warning: Model already has the same reaction you tried to add: EX_arg_D[e]
DM_dopa4sf[c] dopa4sf[c]  ->
DM_dopa4glcur[c] dopa4glcur[c]  ->
DM_dopa3glcur[c] dopa3glcur[c]  ->
DM_34dhpe[c] 34dhpe[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dopa4sf[e]
Warning: Model already has the same reaction you tried to add: EX_dopa4glcur[e]
Warning: Model already has the same reaction you tried to add: EX_dopa3glcur[e]
Warning: Model already has the same reaction you tried to add: EX_CE5026[e]
Warning: Model already has the same reaction you tried to add: EX_5cysgly34dhphe[e]
Warning: Model already has the same reaction you tried to add: EX_CE1261[e]
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_6hddopaqn[c] 6hddopaqn[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_5cysdopa[c] 5cysdopa[c]  ->
DM_23dh1i56dio[c] 23dh1i56dio[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_4glu56dihdind[c] 4glu56dihdind[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_ind56qn[c] ind56qn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4glu56dihdind[e]
Warning: Model already has the same reaction you tried to add: EX_5cysdopa[e]
Warning: Model already has the same reaction you tried to add: EX_CE5025[e]
Warning: Model already has the same reaction you tried to add: EX_CE2172[e]
Warning: Model already has the same reaction you tried to add: EX_CE5629[e]
DM_Rtotal[r] Rtotal[r]  ->
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DM_dhcrm_hs[r] dhcrm_hs[r]  ->
DM_Rtotal[g] Rtotal[g]  ->
DM_sphings[g] sphings[g]  ->
DM_sphgn[g] sphgn[g]  ->
DM_dhcrm_hs[g] dhcrm_hs[g]  ->
DM_phcrm_hs[g] phcrm_hs[g]  ->
DM_phsphings[g] phsphings[g]  ->
DM_phcrm_hs[r] phcrm_hs[r]  ->
DM_phsphings[r] phsphings[r]  ->
Warning: Model already has the same reaction you tried to add: EX_galgluside_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gluside_hs[e]

DM_gm2_hs[l] gm2_hs[l]  ->
DM_gm1_hs[l] gm1_hs[l]  ->
DM_ga2_hs[l] ga2_hs[l]  ->
DM_ga1_hs[l] ga1_hs[l]  ->
DM_gd2_hs[l] gd2_hs[l]  ->
DM_gd1b_hs[l] gd1b_hs[l]  ->
DM_phcrm_hs[c] phcrm_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gd3_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gm3_hs[e]
Warning: Model already has the same reaction you tried to add: EX_ga1_hs[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gd3_hs[l] gd3_hs[l]  ->
DM_thcrm_hs[l] thcrm_hs[l]  ->
Warning: Model already has the same reaction you tried to add: EX_gm1_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gm2_hs[e]

DM_gm3_hs[l] gm3_hs[l]  ->
DM_gm1_hs[c] gm1_hs[c]  ->
DM_gd1a_hs[c] gd1a_hs[c]  ->
DM_gd1b_hs[c] gd1b_hs[c]  ->
DM_gt1b_hs[c] gt1b_hs[c]  ->
DM_ga1_hs[c] ga1_hs[c]  ->
DM_ga2_hs[c] ga2_hs[c]  ->
DM_gm2_hs[c] gm2_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gm1b_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gd1a_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gd1b_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gt1b_hs[e]
Warning: Model already has the same reaction you tried to add: EX_gd2_hs[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gm1_hs[n] gm1_hs[n]  ->
DM_gd1a_hs[n] gd1a_hs[n]  ->
DM_dag_hs[g] dag_hs[g]  ->
DM_pchol_hs[n] pchol_hs[n]  ->
DM_sphmyln_hs[n] sphmyln_hs[n]  ->
DM_phsphings[c] phsphings[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_phsph1p[c] phsph1p[c]  ->
DM_sphings[n] sphings[n]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_sphs1p[n] sphs1p[n]  ->
DM_sphgn[n] sphgn[n]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_sph1p[n] sph1p[n]  ->
DM_cholp[n] cholp[n]  ->
Warning: Model already has the same reaction you tried to add: EX_cmpacna[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gda1_hs[n] gda1_hs[n]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_hhxdcal[c] hhxdcal[c]  ->
Warning: Model already has the same reaction you tried to add: EX_34dhpe[c]
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Warning: Reaction with the same name already exists in the model, updating the reaction
DM_gd3_hs[m] gd3_hs[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_15HPET[x] 15HPET[x]  ->
Warning: Model already has the same reaction you tried to add: EX_M02956[e]
Warning: Model already has the same reaction you tried to add: EX_M00234[e]
Warning: Model already has the same reaction you tried to add: EX_M01807[e]
Warning: Model already has the same reaction you tried to add: EX_M00503[e]
Warning: Model already has the same reaction you tried to add: EX_M00241[e]
Warning: Model already has the same reaction you tried to add: EX_M01820[e]
Warning: Model already has the same reaction you tried to add: EX_M00510[e]
Warning: Model already has the same reaction you tried to add: EX_M00003[e]
Warning: Model already has the same reaction you tried to add: EX_M00008[e]
Warning: Model already has the same reaction you tried to add: EX_M00010[e]
Warning: Model already has the same reaction you tried to add: EX_M00017[e]
Warning: Model already has the same reaction you tried to add: EX_M00019[e]
Warning: Model already has the same reaction you tried to add: EX_M00021[e]
Warning: Model already has the same reaction you tried to add: EX_M00115[e]
Warning: Model already has the same reaction you tried to add: EX_M00117[e]
Warning: Model already has the same reaction you tried to add: EX_M00260[e]
Warning: Model already has the same reaction you tried to add: EX_M00265[e]
Warning: Model already has the same reaction you tried to add: EX_M00315[e]
Warning: Model already has the same reaction you tried to add: EX_M00341[e]
Warning: Model already has the same reaction you tried to add: EX_M01197[e]
Warning: Model already has the same reaction you tried to add: EX_M01207[e]
Warning: Model already has the same reaction you tried to add: EX_M01235[e]
Warning: Model already has the same reaction you tried to add: EX_M01238[e]
Warning: Model already has the same reaction you tried to add: EX_M01582[e]
Warning: Model already has the same reaction you tried to add: EX_M02053[e]
Warning: Model already has the same reaction you tried to add: EX_M02457[e]
Warning: Model already has the same reaction you tried to add: EX_M02613[e]
Warning: Model already has the same reaction you tried to add: EX_M02745[e]
Warning: Model already has the same reaction you tried to add: EX_M03045[e]
Warning: Model already has the same reaction you tried to add: EX_M03051[e]
Warning: Model already has the same reaction you tried to add: EX_M03153[e]
Warning: Model already has the same reaction you tried to add: EX_M02560[e]
Warning: Model already has the same reaction you tried to add: EX_M02561[e]
Warning: Model already has the same reaction you tried to add: EX_C01601[e]
Warning: Model already has the same reaction you tried to add: EX_M02909[e]
Warning: Model already has the same reaction you tried to add: EX_M02108[e]
Warning: Model already has the same reaction you tried to add: EX_M03117[e]
Warning: Model already has the same reaction you tried to add: EX_M03134[e]
DM_xolest2_hs[l] xolest2_hs[l]  ->
DM_xolest2_hs[r] xolest2_hs[r]  ->
DM_M03134[c] M03134[c]  ->
DM_M02694[c] M02694[c]  ->
DM_M02694[m] M02694[m]  ->
DM_M02108[c] M02108[c]  ->
DM_M02107[c] M02107[c]  ->
DM_M02107[m] M02107[m]  ->
DM_M02616[c] M02616[c]  ->
DM_M02616[m] M02616[m]  ->
DM_M03117[c] M03117[c]  ->
DM_M03116[c] M03116[c]  ->
DM_M03116[m] M03116[m]  ->
DM_M03051[c] M03051[c]  ->
DM_M03050[c] M03050[c]  ->
DM_M00129[c] M00129[c]  ->
DM_M00117[c] M00117[c]  ->
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DM_HC10784[c] HC10784[c]  ->
DM_M02745[c] M02745[c]  ->
DM_M01141[c] M01141[c]  ->
DM_M01197[c] M01197[c]  ->
DM_M01191[c] M01191[c]  ->
DM_M00003[c] M00003[c]  ->
DM_M00004[c] M00004[c]  ->
DM_M01238[c] M01238[c]  ->
DM_M01237[c] M01237[c]  ->
DM_M00019[c] M00019[c]  ->
DM_M00020[c] M00020[c]  ->
DM_vacccoa[c] vacccoa[c]  ->
DM_M00127[c] M00127[c]  ->
DM_M00115[c] M00115[c]  ->
DM_M00116[c] M00116[c]  ->
DM_M02613[c] M02613[c]  ->
DM_M02612[c] M02612[c]  ->
DM_M00017[c] M00017[c]  ->
DM_M00018[c] M00018[c]  ->
DM_M01235[c] M01235[c]  ->
DM_M01236[c] M01236[c]  ->
DM_M01207[c] M01207[c]  ->
DM_M00123[c] M00123[c]  ->
DM_M02457[c] M02457[c]  ->
DM_M00101[c] M00101[c]  ->
DM_M02053[c] M02053[c]  ->
DM_M02052[c] M02052[c]  ->
DM_M01582[c] M01582[c]  ->
DM_M00006[c] M00006[c]  ->
DM_M03045[c] M03045[c]  ->
DM_M03047[c] M03047[c]  ->
DM_M03153[c] M03153[c]  ->
DM_M02112[c] M02112[c]  ->
DM_M00010[c] M00010[c]  ->
DM_M00012[c] M00012[c]  ->
DM_M00341[c] M00341[c]  ->
DM_M00343[c] M00343[c]  ->
DM_M00260[c] M00260[c]  ->
DM_M00315[c] M00315[c]  ->
DM_M00008[c] M00008[c]  ->
DM_M00021[c] M00021[c]  ->
DM_M00023[c] M00023[c]  ->
DM_M00265[c] M00265[c]  ->
DM_HC02048[c] HC02048[c]  ->
DM_HC02042[c] HC02042[c]  ->
DM_clpn_hs[m] clpn_hs[m]  ->
DM_HC02050[c] HC02050[c]  ->
DM_HC02051[c] HC02051[c]  ->
DM_HC02054[c] HC02054[c]  ->
DM_HC02056[c] HC02056[c]  ->
DM_HC02057[c] HC02057[c]  ->
DM_HC02060[c] HC02060[c]  ->
DM_M02686[c] M02686[c]  ->
DM_M02758[c] M02758[c]  ->
DM_HC02076[c] HC02076[c]  ->
DM_HC02070[c] HC02070[c]  ->
DM_sphmyln_hs[r] sphmyln_hs[r]  ->
DM_galgluside_hs[r] galgluside_hs[r]  ->
DM_galgbside_hs[c] galgbside_hs[c]  ->
DM_M02197[c] M02197[c]  ->
DM_M02491[c] M02491[c]  ->
DM_M03131[c] M03131[c]  ->
DM_gm1b_hs[c] gm1b_hs[c]  ->
DM_gm3_hs[c] gm3_hs[c]  ->
DM_M02012[l] M02012[l]  ->
DM_M02013[l] M02013[l]  ->
DM_gd2_hs[c] gd2_hs[c]  ->
DM_acglcgalgluside_hs[c] acglcgalgluside_hs[c]  ->
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DM_galacglcgalgluside_hs[c] galacglcgalgluside_hs[c]  ->
DM_M02195[c] M02195[c]  ->
DM_galfucgalacglcgalgluside_hs[c] galfucgalacglcgalgluside_hs[c]  ->
DM_acgalfucgalacglcgalgluside_hs[c] acgalfucgalacglcgalgluside_hs[c]  ->
DM_M02683[c] M02683[c]  ->
DM_acngal14acglcgalgluside_hs[c] acngal14acglcgalgluside_hs[c]  ->
DM_acglcgal14acglcgalgluside_hs[c] acglcgal14acglcgalgluside_hs[c]  ->
DM_galacglcgal14acglcgalgluside_hs[c] galacglcgal14acglcgalgluside_hs[c]  ->
DM_acglcgalacglcgal14acglcgalgluside_hs[c] acglcgalacglcgal14acglcgalgluside_hs[c]  ->
DM_M02186[c] M02186[c]  ->
DM_M02490[c] M02490[c]  ->
DM_M01881[c] M01881[c]  ->
DM_5HPET[m] 5HPET[m]  ->
DM_CE6246[c] CE6246[c]  ->
DM_arachd[n] arachd[n]  ->
DM_12HPET[r] 12HPET[r]  ->
DM_gthox[r] gthox[r]  ->
Warning: Model already has the same reaction you tried to add: EX_M01111[e]
DM_HC02217[r] HC02217[r]  ->
DM_HC02180[r] HC02180[r]  ->
DM_HC01118[c] HC01118[c]  ->
DM_Ssq23epx[c] Ssq23epx[c]  ->
DM_M00939[c] M00939[c]  ->
DM_M00937[c] M00937[c]  ->
DM_44mzym[c] 44mzym[c]  ->
DM_M00961[c] M00961[c]  ->
DM_M00957[c] M00957[c]  ->
DM_4mzym_int1[c] 4mzym_int1[c]  ->
DM_4mzym_int2[c] 4mzym_int2[c]  ->
DM_HC02110[c] HC02110[c]  ->
DM_M00963[c] M00963[c]  ->
DM_M00959[c] M00959[c]  ->
DM_M00955[c] M00955[c]  ->
DM_M01067[c] M01067[c]  ->
DM_zymst[c] zymst[c]  ->
DM_chlstol[c] chlstol[c]  ->
DM_M00940[c] M00940[c]  ->
DM_M00938[c] M00938[c]  ->
DM_M00942[c] M00942[c]  ->
DM_M00962[c] M00962[c]  ->
DM_M00958[c] M00958[c]  ->
DM_M00954[c] M00954[c]  ->
DM_M00966[c] M00966[c]  ->
DM_M00967[c] M00967[c]  ->
DM_M00964[c] M00964[c]  ->
DM_M00960[c] M00960[c]  ->
DM_M00956[c] M00956[c]  ->
DM_M01068[c] M01068[c]  ->
DM_cholcoar[c] cholcoar[c]  ->
DM_cholcoas[m] cholcoas[m]  ->
DM_cholcoaone[m] cholcoaone[m]  ->
DM_HC01459[m] HC01459[m]  ->
DM_M00978[c] M00978[c]  ->
DM_M00976[c] M00976[c]  ->
DM_M01081[c] M01081[c]  ->
DM_M01083[c] M01083[c]  ->
DM_M01077[c] M01077[c]  ->
DM_M01080[c] M01080[c]  ->
DM_M01077[m] M01077[m]  ->
DM_M01080[m] M01080[m]  ->
DM_M01076[m] M01076[m]  ->
DM_M01079[m] M01079[m]  ->
DM_M00746[m] M00746[m]  ->
DM_M00753[m] M00753[m]  ->
DM_M02977[m] M02977[m]  ->
DM_M00742[m] M00742[m]  ->
DM_M02977[c] M02977[c]  ->
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DM_M00742[c] M00742[c]  ->
DM_M00615[c] M00615[c]  ->
DM_M00743[c] M00743[c]  ->
DM_M00615[x] M00615[x]  ->
DM_M00743[x] M00743[x]  ->
DM_M00625[m] M00625[m]  ->
DM_M00625[c] M00625[c]  ->
DM_M00979[c] M00979[c]  ->
DM_M00977[c] M00977[c]  ->
DM_M01082[c] M01082[c]  ->
DM_M01084[c] M01084[c]  ->
DM_20ahchsterol[r] 20ahchsterol[r]  ->
DM_M01989[c] M01989[c]  ->
DM_M02155[c] M02155[c]  ->
DM_M00606[m] M00606[m]  ->
DM_M00579[m] M00579[m]  ->
DM_M00605[c] M00605[c]  ->
DM_M00406[c] M00406[c]  ->
DM_M01075[c] M01075[c]  ->
DM_M01075[r] M01075[r]  ->
DM_M02760[c] M02760[c]  ->
DM_M02761[c] M02761[c]  ->
DM_M00603[c] M00603[c]  ->
DM_M00285[c] M00285[c]  ->
DM_M00429[m] M00429[m]  ->
DM_hestratriol[l] hestratriol[l]  ->
DM_CE5253[l] CE5253[l]  ->
DM_3ohxccoa[c] 3ohxccoa[c]  ->
DM_M00783[c] M00783[c]  ->
DM_M00049[c] M00049[c]  ->
DM_M00887[c] M00887[c]  ->
DM_M00790[c] M00790[c]  ->
DM_M00054[c] M00054[c]  ->
DM_M00873[c] M00873[c]  ->
DM_M00778[c] M00778[c]  ->
DM_M00044[c] M00044[c]  ->
DM_M00907[c] M00907[c]  ->
DM_M00802[c] M00802[c]  ->
DM_M00067[c] M00067[c]  ->
DM_M00879[c] M00879[c]  ->
DM_M00715[c] M00715[c]  ->
DM_M03016[c] M03016[c]  ->
DM_M00843[c] M00843[c]  ->
DM_M00702[c] M00702[c]  ->
DM_M03014[c] M03014[c]  ->
DM_M00852[c] M00852[c]  ->
DM_M00707[c] M00707[c]  ->
DM_M03018[c] M03018[c]  ->
DM_M00839[c] M00839[c]  ->
DM_M00699[c] M00699[c]  ->
DM_M03011[c] M03011[c]  ->
DM_M00871[c] M00871[c]  ->
DM_M00704[c] M00704[c]  ->
DM_M03017[c] M03017[c]  ->
DM_CE4791[c] CE4791[c]  ->
DM_M00860[c] M00860[c]  ->
DM_M00085[c] M00085[c]  ->
DM_M03008[c] M03008[c]  ->
DM_M00869[c] M00869[c]  ->
DM_M00086[c] M00086[c]  ->
DM_M03005[c] M03005[c]  ->
DM_M00862[c] M00862[c]  ->
DM_M00712[c] M00712[c]  ->
DM_M03006[c] M03006[c]  ->
DM_M01729[c] M01729[c]  ->
DM_M01729[m] M01729[m]  ->
DM_M03050[m] M03050[m]  ->
DM_M02973[c] M02973[c]  ->
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DM_M02973[m] M02973[m]  ->
DM_M00129[m] M00129[m]  ->
DM_M02976[c] M02976[c]  ->
DM_M02976[m] M02976[m]  ->
DM_M01141[m] M01141[m]  ->
DM_M01191[m] M01191[m]  ->
DM_M02102[c] M02102[c]  ->
DM_M02102[m] M02102[m]  ->
DM_M00004[m] M00004[m]  ->
DM_M02103[c] M02103[c]  ->
DM_M02103[m] M02103[m]  ->
DM_M01237[m] M01237[m]  ->
DM_M00020[m] M00020[m]  ->
DM_vacccrn[c] vacccrn[c]  ->
DM_vacccrn[m] vacccrn[m]  ->
DM_vacccoa[m] vacccoa[m]  ->
DM_M00127[m] M00127[m]  ->
DM_M02638[c] M02638[c]  ->
DM_M02638[m] M02638[m]  ->
DM_M00116[m] M00116[m]  ->
DM_M02611[c] M02611[c]  ->
DM_M02611[m] M02611[m]  ->
DM_M02612[m] M02612[m]  ->
DM_M01776[c] M01776[c]  ->
DM_M01776[m] M01776[m]  ->
DM_M00018[m] M00018[m]  ->
DM_M01777[c] M01777[c]  ->
DM_M01777[m] M01777[m]  ->
DM_CE5151[m] CE5151[m]  ->
DM_M01775[c] M01775[c]  ->
DM_M01775[m] M01775[m]  ->
DM_M01236[m] M01236[m]  ->
DM_M00122[c] M00122[c]  ->
DM_M00122[m] M00122[m]  ->
DM_M00123[m] M00123[m]  ->
DM_M00100[c] M00100[c]  ->
DM_M00100[m] M00100[m]  ->
DM_M00101[m] M00101[m]  ->
DM_M02051[c] M02051[c]  ->
DM_M02051[m] M02051[m]  ->
DM_M02052[m] M02052[m]  ->
DM_M01724[c] M01724[c]  ->
DM_M01724[m] M01724[m]  ->
DM_M01727[c] M01727[c]  ->
DM_M01727[m] M01727[m]  ->
DM_CE5155[m] CE5155[m]  ->
DM_M01726[c] M01726[c]  ->
DM_M01726[m] M01726[m]  ->
DM_M00006[m] M00006[m]  ->
DM_M02637[c] M02637[c]  ->
DM_M02637[m] M02637[m]  ->
DM_M00011[c] M00011[c]  ->
DM_M00011[m] M00011[m]  ->
DM_M00012[m] M00012[m]  ->
DM_M00342[c] M00342[c]  ->
DM_M00342[m] M00342[m]  ->
DM_M00343[m] M00343[m]  ->
DM_M00261[c] M00261[c]  ->
DM_M00261[m] M00261[m]  ->
DM_CE4854[m] CE4854[m]  ->
DM_M01770[c] M01770[c]  ->
DM_M01770[m] M01770[m]  ->
DM_CE4843[m] CE4843[m]  ->
DM_M00022[c] M00022[c]  ->
DM_M00022[m] M00022[m]  ->
DM_M00023[m] M00023[m]  ->
DM_M00263[c] M00263[c]  ->
DM_M00263[m] M00263[m]  ->
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DM_CE4847[m] CE4847[m]  ->
DM_ddcacoa[r] ddcacoa[r]  ->
DM_M03050[r] M03050[r]  ->
DM_tdcoa[r] tdcoa[r]  ->
DM_M00129[r] M00129[r]  ->
DM_HC10784[r] HC10784[r]  ->
DM_M01141[r] M01141[r]  ->
DM_ptdcacoa[r] ptdcacoa[r]  ->
DM_M01191[r] M01191[r]  ->
DM_hpdcacoa[r] hpdcacoa[r]  ->
DM_M00004[r] M00004[r]  ->
DM_M01237[r] M01237[r]  ->
DM_stcrn[r] stcrn[r]  ->
DM_odecrn[r] odecrn[r]  ->
DM_M00020[r] M00020[r]  ->
DM_vacccoa[r] vacccoa[r]  ->
DM_M00127[r] M00127[r]  ->
DM_lneldccoa[r] lneldccoa[r]  ->
DM_M02612[r] M02612[r]  ->
DM_arachcoa[r] arachcoa[r]  ->
DM_M01236[r] M01236[r]  ->
DM_M00018[r] M00018[r]  ->
DM_M00123[r] M00123[r]  ->
DM_M00101[r] M00101[r]  ->
DM_M02052[r] M02052[r]  ->
DM_M01724[r] M01724[r]  ->
DM_docoscoa[r] docoscoa[r]  ->
DM_M00006[r] M00006[r]  ->
DM_M02637[r] M02637[r]  ->
DM_strdnccrn[r] strdnccrn[r]  ->
DM_tmndnccrn[r] tmndnccrn[r]  ->
DM_c226coa[r] c226coa[r]  ->
DM_M00012[r] M00012[r]  ->
DM_M00343[r] M00343[r]  ->
DM_lnlncgcrn[r] lnlncgcrn[r]  ->
DM_dlnlcgcrn[r] dlnlcgcrn[r]  ->
DM_dcsptn1coa[r] dcsptn1coa[r]  ->
DM_M00023[r] M00023[r]  ->
DM_M03047[r] M03047[r]  ->
DM_ttccoa[r] ttccoa[r]  ->
DM_hexccoa[r] hexccoa[r]  ->
DM_M02112[r] M02112[r]  ->
DM_tetpent3coa[r] tetpent3coa[r]  ->
DM_tettet6coa[r] tettet6coa[r]  ->
DM_ddca[r] ddca[r]  ->
DM_M03051[r] M03051[r]  ->
DM_ttdca[r] ttdca[r]  ->
DM_M02745[r] M02745[r]  ->
DM_ttdcea[r] ttdcea[r]  ->
DM_M00117[r] M00117[r]  ->
DM_ptdca[r] ptdca[r]  ->
DM_M01197[r] M01197[r]  ->
DM_hpdca[r] hpdca[r]  ->
DM_M00003[r] M00003[r]  ->
DM_M01238[r] M01238[r]  ->
DM_elaid[r] elaid[r]  ->
DM_M00019[r] M00019[r]  ->
DM_vacc[r] vacc[r]  ->
DM_lneldc[r] lneldc[r]  ->
DM_M02613[r] M02613[r]  ->
DM_arach[r] arach[r]  ->
DM_CE2510[r] CE2510[r]  ->
DM_M00017[r] M00017[r]  ->
DM_M01235[r] M01235[r]  ->
DM_M01207[r] M01207[r]  ->
DM_M02457[r] M02457[r]  ->
DM_M02053[r] M02053[r]  ->
DM_doco13ac[r] doco13ac[r]  ->
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DM_M01582[r] M01582[r]  ->
DM_M03045[r] M03045[r]  ->
DM_lgnc[r] lgnc[r]  ->
DM_nrvnc[r] nrvnc[r]  ->
DM_hexc[r] hexc[r]  ->
DM_M03153[r] M03153[r]  ->
DM_eicostet[r] eicostet[r]  ->
DM_clpnd[r] clpnd[r]  ->
DM_tetpent3[r] tetpent3[r]  ->
DM_crvnc[r] crvnc[r]  ->
DM_M00010[r] M00010[r]  ->
DM_M00341[r] M00341[r]  ->
DM_adrn[r] adrn[r]  ->
DM_tettet6[r] tettet6[r]  ->
DM_dcsptn1[r] dcsptn1[r]  ->
DM_M00008[r] M00008[r]  ->
DM_M00021[r] M00021[r]  ->
DM_M03047[x] M03047[x]  ->
DM_CE4855[x] CE4855[x]  ->
DM_M02112[x] M02112[x]  ->
DM_M00049[x] M00049[x]  ->
DM_M00783[x] M00783[x]  ->
DM_CE2245[x] CE2245[x]  ->
DM_CE2249[x] CE2249[x]  ->
DM_CE2253[x] CE2253[x]  ->
DM_CE2242[x] CE2242[x]  ->
DM_CE2246[x] CE2246[x]  ->
DM_CE2250[x] CE2250[x]  ->
DM_CE2243[x] CE2243[x]  ->
DM_CE2247[x] CE2247[x]  ->
DM_CE2251[x] CE2251[x]  ->
DM_od2coa[x] od2coa[x]  ->
DM_CE2248[x] CE2248[x]  ->
DM_HC01415[x] HC01415[x]  ->
DM_HC01405[x] HC01405[x]  ->
DM_HC01406[x] HC01406[x]  ->
DM_HC01407[x] HC01407[x]  ->
DM_HC01408[x] HC01408[x]  ->
DM_CE2242[m] CE2242[m]  ->
DM_CE2246[m] CE2246[m]  ->
DM_CE2250[m] CE2250[m]  ->
DM_CE2243[m] CE2243[m]  ->
DM_CE2247[m] CE2247[m]  ->
DM_CE2251[m] CE2251[m]  ->
DM_CE2248[m] CE2248[m]  ->
DM_3ohodcoa[m] 3ohodcoa[m]  ->
DM_M00044[m] M00044[m]  ->
DM_M00778[m] M00778[m]  ->
DM_M00873[m] M00873[m]  ->
DM_M00054[m] M00054[m]  ->
DM_M00790[m] M00790[m]  ->
DM_M00887[m] M00887[m]  ->
DM_M00046[m] M00046[m]  ->
DM_M00780[m] M00780[m]  ->
DM_M00875[m] M00875[m]  ->
DM_M00061[m] M00061[m]  ->
DM_M00795[m] M00795[m]  ->
DM_M00897[m] M00897[m]  ->
DM_M00069[m] M00069[m]  ->
DM_M00804[m] M00804[m]  ->
DM_M00909[m] M00909[m]  ->
DM_M00071[m] M00071[m]  ->
DM_M00806[m] M00806[m]  ->
DM_M00911[m] M00911[m]  ->
DM_M00056[m] M00056[m]  ->
DM_M00792[m] M00792[m]  ->
DM_M00889[m] M00889[m]  ->
DM_M00048[m] M00048[m]  ->
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DM_M00782[m] M00782[m]  ->
DM_M00877[m] M00877[m]  ->
DM_M00063[m] M00063[m]  ->
DM_M00797[m] M00797[m]  ->
DM_M00899[m] M00899[m]  ->
DM_CE5154[m] CE5154[m]  ->
DM_CE5153[m] CE5153[m]  ->
DM_CE5152[m] CE5152[m]  ->
DM_CE5150[m] CE5150[m]  ->
DM_CE5148[m] CE5148[m]  ->
DM_CE5144[m] CE5144[m]  ->
DM_M03019[m] M03019[m]  ->
DM_M00172[m] M00172[m]  ->
DM_M00849[m] M00849[m]  ->
DM_M03022[m] M03022[m]  ->
DM_M01573[m] M01573[m]  ->
DM_M00885[m] M00885[m]  ->
DM_M03014[m] M03014[m]  ->
DM_M00702[m] M00702[m]  ->
DM_M00843[m] M00843[m]  ->
DM_M03024[m] M03024[m]  ->
DM_M00170[m] M00170[m]  ->
DM_M00841[m] M00841[m]  ->
DM_M03016[x] M03016[x]  ->
DM_M00715[x] M00715[x]  ->
DM_M00879[x] M00879[x]  ->
DM_CE5158[x] CE5158[x]  ->
DM_CE5157[x] CE5157[x]  ->
DM_CE5156[x] CE5156[x]  ->
DM_CE5155[x] CE5155[x]  ->

Warning: Model already has the same reaction you tried to add: EX_nadh[e]

DM_dsT_antigen[c] dsT_antigen[c]  ->
DM_ocdca[r] ocdca[r]  ->
DM_M00245[c] M00245[c]  ->
Warning: Model already has the same reaction you tried to add: EX_h2co3[e]

DM_dhlam[c] dhlam[c]  ->
DM_pail5p_hs[g] pail5p_hs[g]  ->
DM_coucoa[c] coucoa[c]  ->
DM_4hbzcoa[c] 4hbzcoa[c]  ->
DM_M00658[m] M00658[m]  ->
DM_M01165[m] M01165[m]  ->
DM_M00770[m] M00770[m]  ->
DM_peplys[c] peplys[c]  ->
DM_M00213[c] M00213[c]  ->
DM_Ndmelys[c] Ndmelys[c]  ->
DM_Ntmelys[c] Ntmelys[c]  ->
DM_M01871[g] M01871[g]  ->
DM_M01872[g] M01872[g]  ->
Warning: Model already has the same reaction you tried to add: EX_M01872[e]

DM_sTn_antigen[c] sTn_antigen[c]  ->
DM_Ser_Gly_Ala_X_Gly[c] Ser_Gly_Ala_X_Gly[c]  ->
DM_doldp_L[c] doldp_L[c]  ->
DM_M01869[g] M01869[g]  ->
DM_M01870[g] M01870[g]  ->
Warning: Model already has the same reaction you tried to add: EX_M01870[e]

DM_Ser_Gly_Ala_X_Gly[g] Ser_Gly_Ala_X_Gly[g]  ->
DM_M00673[c] M00673[c]  ->
DM_M01389[c] M01389[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ditp[e]

DM_HC01361[c] HC01361[c]  ->
Warning: Model already has the same reaction you tried to add: EX_hnifedipine[e]

DM_HC02057[r] HC02057[r]  ->
DM_M02446[c] M02446[c]  ->
Warning: Model already has the same reaction you tried to add: EX_M02446[e]
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DM_M02447[c] M02447[c]  ->
Warning: Model already has the same reaction you tried to add: EX_M02447[e]

DM_M02449[c] M02449[c]  ->
Warning: Model already has the same reaction you tried to add: EX_M02449[e]

DM_M02451[c] M02451[c]  ->
Warning: Model already has the same reaction you tried to add: EX_M02451[e]

DM_M01966[c] M01966[c]  ->
DM_itacon[c] itacon[c]  ->
Warning: Model already has the same reaction you tried to add: EX_itacon[e]
Warning: Model already has the same reaction you tried to add: EX_adpman[e]
Warning: Model already has the same reaction you tried to add: EX_rbl_D[e]
Warning: Model already has the same reaction you tried to add: EX_M01966[e]
Warning: Model already has the same reaction you tried to add: EX_M02155[e]
Warning: Model already has the same reaction you tried to add: EX_M01989[e]
Warning: Model already has the same reaction you tried to add: EX_M02837[e]

DM_M02035[c] M02035[c]  ->
DM_M02035[e] M02035[e]  ->
DM_M02467[c] M02467[c]  ->
DM_M02467[e] M02467[e]  ->
DM_gpi_sig[c] gpi_sig[c]  ->
DM_m3gacpail_prot_hs[c] m3gacpail_prot_hs[c]  ->
DM_mem2emgacpail_prot_hs[c] mem2emgacpail_prot_hs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gpi_sig[e]
Warning: Model already has the same reaction you tried to add: EX_M01881[e]
Warning: Model already has the same reaction you tried to add: EX_M03131[e]

DM_n5m2masn[c] n5m2masn[c]  ->
Warning: Model already has the same reaction you tried to add: EX_n5m2masn[e]
Warning: Model already has the same reaction you tried to add: EX_hretn[e]
Warning: Model already has the same reaction you tried to add: EX_kdn[e]
Warning: Model already has the same reaction you tried to add: EX_m3gacpail_prot_hs[e]

DM_core5[c] core5[c]  ->
DM_core7[c] core7[c]  ->
DM_core8[c] core8[c]  ->
Warning: Model already has the same reaction you tried to add: sink_xolest2_hs[l]
Warning: Model already has the same reaction you tried to add: EX_dolichol_L[e]

DM_M03167[c] M03167[c]  ->
DM_M03168[m] M03168[m]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_12dhchol[c] 12dhchol[c]  ->
Warning: Model already has the same reaction you tried to add: EX_12dhchol[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_3dhchol[c] 3dhchol[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_3dhcdchol[c] 3dhcdchol[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3dhcdchol[e]
Warning: Model already has the same reaction you tried to add: EX_3dhchol[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_3dhdchol[c] 3dhdchol[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3dhdchol[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_3dhlchol[c] 3dhlchol[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3dhlchol[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_7dhcdchol[c] 7dhcdchol[c]  ->
Warning: Model already has the same reaction you tried to add: EX_7dhcdchol[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_7dhchol[c] 7dhchol[c]  ->
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Warning: Model already has the same reaction you tried to add: EX_7dhchol[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_ca24g[c] ca24g[c]  ->
DM_ca24g[r] ca24g[r]  ->
Warning: Model already has the same reaction you tried to add: EX_ca24g[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_ca3s[c] ca3s[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ca3s[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_cdca24g[c] cdca24g[c]  ->
DM_cdca24g[r] cdca24g[r]  ->
Warning: Model already has the same reaction you tried to add: EX_cdca24g[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_cdca3g[c] cdca3g[c]  ->
DM_cdca3g[r] cdca3g[r]  ->
Warning: Model already has the same reaction you tried to add: EX_cdca3g[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_hyochol[c] hyochol[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_coprost[c] coprost[c]  ->
Warning: Model already has the same reaction you tried to add: EX_coprost[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_dca24g[c] dca24g[c]  ->
DM_dca24g[r] dca24g[r]  ->
Warning: Model already has the same reaction you tried to add: EX_dca24g[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_dca3g[c] dca3g[c]  ->
DM_dca3g[r] dca3g[r]  ->
Warning: Model already has the same reaction you tried to add: EX_dca3g[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_dca3s[c] dca3s[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dca3s[e]
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gca3s[c] gca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gcdca3s[c] gcdca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gdca3s[c] gdca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_gudca3s[c] gudca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_hca24g[c] hca24g[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_hca6g[c] hca6g[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_hdca24g[c] hdca24g[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_hdca6g[c] hdca6g[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_icdchol[c] icdchol[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_isochol[c] isochol[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_lca24g[c] lca24g[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction

DM_lca3g[c] lca3g[c]  ->
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Warning: Reaction with the same name already exists in the model, updating the reaction
DM_lca3s[c] lca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_tca3s[c] tca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_tcdca3s[c] tcdca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_tdca3s[c] tdca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_thyochol[c] thyochol[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_tudca3s[c] tudca3s[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_uchol[c] uchol[c]  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_udca3s[c] udca3s[c]  ->
Warning: Model already has the same reaction you tried to add: EX_gca3s[e]
Warning: Model already has the same reaction you tried to add: EX_gcdca3s[e]
Warning: Model already has the same reaction you tried to add: EX_gdca3s[e]
Warning: Model already has the same reaction you tried to add: EX_gudca3s[e]
Warning: Model already has the same reaction you tried to add: EX_hca24g[e]
Warning: Model already has the same reaction you tried to add: EX_hca6g[e]
Warning: Model already has the same reaction you tried to add: EX_hdca24g[e]
Warning: Model already has the same reaction you tried to add: EX_hdca6g[e]
Warning: Model already has the same reaction you tried to add: EX_hyochol[e]
Warning: Model already has the same reaction you tried to add: EX_icdchol[e]
Warning: Model already has the same reaction you tried to add: EX_isochol[e]
Warning: Model already has the same reaction you tried to add: EX_lca24g[e]
Warning: Model already has the same reaction you tried to add: EX_lca3g[e]
Warning: Model already has the same reaction you tried to add: EX_lca3s[e]
Warning: Model already has the same reaction you tried to add: EX_tca3s[e]
Warning: Model already has the same reaction you tried to add: EX_tcdca3s[e]
Warning: Model already has the same reaction you tried to add: EX_tdca3s[e]
Warning: Model already has the same reaction you tried to add: EX_thyochol[e]
Warning: Model already has the same reaction you tried to add: EX_tudca3s[e]
Warning: Model already has the same reaction you tried to add: EX_uchol[e]
Warning: Model already has the same reaction you tried to add: EX_udca3s[e]
DM_hyochol[r] hyochol[r]  ->
DM_hca24g[r] hca24g[r]  ->
DM_hca6g[r] hca6g[r]  ->
DM_M02155[r] M02155[r]  ->
DM_hdca24g[r] hdca24g[r]  ->
DM_hdca6g[r] hdca6g[r]  ->
DM_lca24g[r] lca24g[r]  ->
DM_lca3g[r] lca3g[r]  ->
DM_tacr[r] tacr[r]  ->
DM_12htacr[r] 12htacr[r]  ->
DM_12htacr[c] 12htacr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_12htacr[e]
DM_13dmt[r] 13dmt[r]  ->
DM_1331tacr[r] 1331tacr[r]  ->
DM_31dmt[r] 31dmt[r]  ->
DM_1331tacr[c] 1331tacr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1331tacr[e]
DM_13dmt[c] 13dmt[c]  ->
Warning: Model already has the same reaction you tried to add: EX_13dmt[e]
DM_4ohmdz[r] 4ohmdz[r]  ->
DM_14hmdz[r] 14hmdz[r]  ->
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DM_1ohmdz[r] 1ohmdz[r]  ->
DM_14hmdz[c] 14hmdz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_14hmdz[e]

DM_15dmt[r] 15dmt[r]  ->
DM_1513tacr[r] 1513tacr[r]  ->
DM_1513tacr[c] 1513tacr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1513tacr[e]

DM_1531tacr[r] 1531tacr[r]  ->
DM_1531tacr[c] 1531tacr[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1531tacr[e]

DM_15dmt[c] 15dmt[c]  ->
Warning: Model already has the same reaction you tried to add: EX_15dmt[e]

DM_1hibupglu_S[c] 1hibupglu_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1hibupglu_S[e]

DM_1hibup_S[r] 1hibup_S[r]  ->
DM_1hibupglu_S[r] 1hibupglu_S[r]  ->
DM_1hibup_S[c] 1hibup_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1hibup_S[e]

DM_1hmdgluc[r] 1hmdgluc[r]  ->
Warning: Model already has the same reaction you tried to add: EX_1hmdgluc[e]

DM_1hmdgluc[c] 1hmdgluc[c]  ->
DM_mdz[r] mdz[r]  ->
DM_1ohmdz[c] 1ohmdz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1ohmdz[e]

DM_2hatvacid[c] 2hatvacid[c]  ->
DM_2hatvlac[c] 2hatvlac[c]  ->
DM_2hatvacid[r] 2hatvacid[r]  ->
DM_2hatvacidgluc[r] 2hatvacidgluc[r]  ->
DM_2hatvacidgluc[c] 2hatvacidgluc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2hatvacidgluc[e]

DM_atvacid[r] atvacid[r]  ->
Warning: Model already has the same reaction you tried to add: EX_2hatvacid[e]

DM_2hatvlac[r] 2hatvlac[r]  ->
DM_2hatvlacgluc[r] 2hatvlacgluc[r]  ->
DM_2hatvlacgluc[c] 2hatvlacgluc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2hatvlacgluc[e]

DM_atvlac[r] atvlac[r]  ->
Warning: Model already has the same reaction you tried to add: EX_2hatvlac[e]

DM_2hibupglu_S[c] 2hibupglu_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2hibupglu_S[e]

DM_2hibup_R[c] 2hibup_R[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2hibup_R[e]

DM_2hibup_S[r] 2hibup_S[r]  ->
DM_2hibupglu_S[r] 2hibupglu_S[r]  ->
DM_2hibup_S[c] 2hibup_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_2hibup_S[e]

DM_31dmt[c] 31dmt[c]  ->
Warning: Model already has the same reaction you tried to add: EX_31dmt[e]

DM_pvs[r] pvs[r]  ->
DM_35dhpvs[r] 35dhpvs[r]  ->
DM_35dhpvs[c] 35dhpvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_35dhpvs[e]

DM_smv[r] smv[r]  ->
DM_35dsmv[r] 35dsmv[r]  ->
DM_35dsmv[c] 35dsmv[c]  ->
Warning: Model already has the same reaction you tried to add: EX_35dsmv[e]

DM_3hibupglu_S[c] 3hibupglu_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hibupglu_S[e]

DM_3hibup_R[c] 3hibup_R[c]  ->
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Warning: Model already has the same reaction you tried to add: EX_3hibup_R[e]

DM_3hibup_S[r] 3hibup_S[r]  ->
DM_3hibupglu_S[r] 3hibupglu_S[r]  ->
DM_3hibup_S[c] 3hibup_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hibup_S[e]

DM_3hlvst[c] 3hlvst[c]  ->
DM_3hlvstacid[c] 3hlvstacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hlvstacid[e]

DM_3hpvscoa[m] 3hpvscoa[m]  ->
DM_3hpvstetcoa[m] 3hpvstetcoa[m]  ->
DM_3hpvscoa[x] 3hpvscoa[x]  ->
DM_3hpvstetcoa[x] 3hpvstetcoa[x]  ->
DM_3hpvstet[c] 3hpvstet[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hpvstet[e]

DM_3hpvs[r] 3hpvs[r]  ->
DM_3hpvs[c] 3hpvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hpvs[e]

DM_3hsmv[c] 3hsmv[c]  ->
DM_3hsmvacid[c] 3hsmvacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3hsmvacid[e]

DM_6hsmv[r] 6hsmv[r]  ->
DM_3hsmv[r] 3hsmv[r]  ->
DM_pvs[c] pvs[c]  ->
DM_3ispvs[c] 3ispvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_3ispvs[e]

DM_3ohacmp[c] 3ohacmp[c]  ->
DM_3meacmp[c] 3meacmp[c]  ->
DM_acmp[r] acmp[r]  ->
DM_3ohacmp[r] 3ohacmp[r]  ->
Warning: Model already has the same reaction you tried to add: EX_3ohacmp[e]

DM_4bhglz[c] 4bhglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4bhglz[e]

DM_glz[r] glz[r]  ->
DM_4bhglz[r] 4bhglz[r]  ->
DM_4hatvacid[r] 4hatvacid[r]  ->
DM_4hatvlac[c] 4hatvlac[c]  ->
DM_4hatvacid[c] 4hatvacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4hatvacid[e]

DM_4hatvlac[r] 4hatvlac[r]  ->
Warning: Model already has the same reaction you tried to add: EX_4hatvlac[e]

DM_4hmdgluc[c] 4hmdgluc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4hmdgluc[e]

DM_4hmdgluc[r] 4hmdgluc[r]  ->
DM_4ohmdz[c] 4ohmdz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_4ohmdz[e]

DM_tripvs[r] tripvs[r]  ->
DM_56dhpvs[r] 56dhpvs[r]  ->
DM_56dhpvs[c] 56dhpvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_56dhpvs[e]

DM_3ispvs[r] 3ispvs[r]  ->
DM_56eppvs[r] 56eppvs[r]  ->
DM_56eppvs[c] 56eppvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_56eppvs[e]

DM_5ohfvs[r] 5ohfvs[r]  ->
DM_5ohfvsglu[r] 5ohfvsglu[r]  ->
DM_5ohfvsglu[c] 5ohfvsglu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5ohfvsglu[e]

DM_fvs[r] fvs[r]  ->
DM_5ohfvs[c] 5ohfvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_5ohfvs[e]
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DM_6ahglz[c] 6ahglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6ahglz[e]

DM_6ahglz[r] 6ahglz[r]  ->
DM_6bhglz[c] 6bhglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6bhglz[e]

DM_6bhglzglc[c] 6bhglzglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6bhglzglc[e]

DM_6bhglz[r] 6bhglz[r]  ->
DM_6bhglzglc[r] 6bhglzglc[r]  ->
DM_6csmv[c] 6csmv[c]  ->
DM_6csmvacid[c] 6csmvacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6csmvacid[e]

DM_6msmv[r] 6msmv[r]  ->
DM_6csmv[r] 6csmv[r]  ->
DM_6epvs[c] 6epvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6epvs[e]

DM_6hlvst[c] 6hlvst[c]  ->
DM_6hlvstacid[c] 6hlvstacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6hlvst[e]

DM_6hmsmv[c] 6hmsmv[c]  ->
DM_6hmsmvacid[c] 6hmsmvacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6hmsmvacid[e]

DM_6hmsmv[r] 6hmsmv[r]  ->
DM_6hsmv[c] 6hsmv[c]  ->
DM_6hsmvacid[c] 6hsmvacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6hsmvacid[e]

DM_6melvst[c] 6melvst[c]  ->
DM_6melvacid[c] 6melvacid[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6melvacid[e]
Warning: Model already has the same reaction you tried to add: EX_6melvst[e]

DM_6ohfvsglu[r] 6ohfvsglu[r]  ->
DM_6ohfvsglu[c] 6ohfvsglu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6ohfvsglu[e]

DM_6ohfvs[r] 6ohfvs[r]  ->
DM_6ohfvs[c] 6ohfvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_6ohfvs[e]

DM_7ahglz[c] 7ahglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_7ahglz[e]

DM_7ahglz[r] 7ahglz[r]  ->
DM_7bhglz[c] 7bhglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_7bhglz[e]

DM_7bhglzglc[c] 7bhglzglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_7bhglzglc[e]

DM_7bhglz[r] 7bhglz[r]  ->
DM_7bhglzglc[r] 7bhglzglc[r]  ->
DM_7hpvs[r] 7hpvs[r]  ->
DM_7hpvs[c] 7hpvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_7hpvs[e]
Warning: Model already has the same reaction you tried to add: EX_allop[e]

DM_allop[c] allop[c]  ->
DM_acmp[c] acmp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acmp[e]

DM_acmpglu[r] acmpglu[r]  ->
Warning: Model already has the same reaction you tried to add: EX_acmpglut[e]

DM_acmpglut[c] acmpglut[c]  ->
DM_acmpglu[c] acmpglu[c]  ->
Warning: Model already has the same reaction you tried to add: EX_acmpglu[e]

DM_sulpacmp[c] sulpacmp[c]  ->
DM_oxyp[c] oxyp[c]  ->
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DM_am1csa[r] am1csa[r]  ->
DM_am19cs[r] am19cs[r]  ->
DM_am9csa[r] am9csa[r]  ->
DM_am19cs[c] am19cs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am19cs[e]

DM_am1acs[c] am1acs[c]  ->
DM_am1a4ncs[c] am1a4ncs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am1a4ncs[e]

DM_am1ccs[r] am1ccs[r]  ->
DM_am1accs[r] am1accs[r]  ->
DM_am1accs[c] am1accs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am1accs[e]

DM_am1alcs[r] am1alcs[r]  ->
DM_am1acs[r] am1acs[r]  ->
Warning: Model already has the same reaction you tried to add: EX_am1acs[e]

DM_am1csa[c] am1csa[c]  ->
DM_am1alcs[c] am1alcs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am1alcs[e]

DM_am1c9cs[c] am1c9cs[c]  ->
DM_am1c4n9cs[c] am1c4n9cs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am1c4n9cs[e]

DM_am1c9cs[r] am1c9cs[r]  ->
Warning: Model already has the same reaction you tried to add: EX_am1c9cs[e]

DM_csa[r] csa[r]  ->
DM_am1ccs[c] am1ccs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am1ccs[e]

DM_am1cglc[r] am1cglc[r]  ->
DM_am1cglc[c] am1cglc[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am1cglc[e]
Warning: Model already has the same reaction you tried to add: EX_am1csa[e]

DM_am9csa[c] am9csa[c]  ->
DM_am4n9cs[c] am4n9cs[c]  ->
DM_am4ncs[r] am4ncs[r]  ->
DM_am4n9cs[r] am4n9cs[r]  ->
Warning: Model already has the same reaction you tried to add: EX_am4n9cs[e]

DM_csa[c] csa[c]  ->
DM_am4ncs[c] am4ncs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_am4ncs[e]
Warning: Model already has the same reaction you tried to add: EX_am9csa[e]
Warning: Model already has the same reaction you tried to add: EX_atvacid[e]

DM_atvacid[c] atvacid[c]  ->
DM_atvlac[c] atvlac[c]  ->
DM_atvethgluc[r] atvethgluc[r]  ->
DM_atvacylgluc[r] atvacylgluc[r]  ->
DM_atvlacgluc[r] atvlacgluc[r]  ->
Warning: Model already has the same reaction you tried to add: EX_atvlac[e]

DM_caribupglu_S[c] caribupglu_S[c]  ->
Warning: Model already has the same reaction you tried to add: EX_caribupglu_S[e]

DM_caribup_R[c] caribup_R[c]  ->
Warning: Model already has the same reaction you tried to add: EX_caribup_R[e]

DM_caribup_s[r] caribup_s[r]  ->
DM_caribupglu_S[r] caribupglu_S[r]  ->
DM_caribup_s[c] caribup_s[c]  ->
Warning: Model already has the same reaction you tried to add: EX_caribup_s[e]

DM_crglz[c] crglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_crglz[e]

DM_mhglz[r] mhglz[r]  ->
DM_crglz[r] crglz[r]  ->
DM_crvsm1[r] crvsm1[r]  ->
DM_crvsm24[r] crvsm24[r]  ->
```

```
DM_crvsm1[c] crvsm1[c]  ->
Warning: Model already has the same reaction you tried to add: EX_crvsm1[e]

DM_crvsm23[r] crvsm23[r]  ->
Warning: Model already has the same reaction you tried to add: EX_crvs[e]

DM_crvs[c] crvs[c]  ->
DM_crvsm22[c] crvsm22[c]  ->
DM_crvs[r] crvs[r]  ->
DM_cvm1gluc[r] cvm1gluc[r]  ->
DM_crvsm22[r] crvsm22[r]  ->
DM_cvm23gluc[r] cvm23gluc[r]  ->
DM_crvsm23[c] crvsm23[c]  ->
Warning: Model already has the same reaction you tried to add: EX_crvsm23[e]

DM_crvsm24[c] crvsm24[c]  ->
Warning: Model already has the same reaction you tried to add: EX_crvsm24[e]

DM_crvsm31[r] crvsm31[r]  ->
DM_csasulp[c] csasulp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_csasulp[e]
Warning: Model already has the same reaction you tried to add: EX_csa[e]

DM_cysacmp[c] cysacmp[c]  ->
DM_meracmp[c] meracmp[c]  ->
Warning: Model already has the same reaction you tried to add: EX_cysacmp[e]

DM_crvsm31[c] crvsm31[c]  ->
DM_fvs[x] fvs[x]  ->
DM_deoxfvs[x] deoxfvs[x]  ->
DM_deoxfvs[c] deoxfvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_deoxfvs[e]

DM_desfvs[r] desfvs[r]  ->
DM_desfvs[c] desfvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_desfvs[e]

DM_dhglz[c] dhglz[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dhglz[e]

DM_glz[c] glz[c]  ->
DM_dspvs[r] dspvs[r]  ->
DM_dspvs[c] dspvs[c]  ->
Warning: Model already has the same reaction you tried to add: EX_dspvs[e]

DM_epoxtac[r] epoxtac[r]  ->
DM_epoxtac[c] epoxtac[c]  ->
Warning: Model already has the same reaction you tried to add: EX_epoxtac[e]
Warning: Model already has the same reaction you tried to add: EX_fvs[e]
Warning: Model already has the same reaction you tried to add: EX_fvstet[e]
Warning: Model already has the same reaction you tried to add: EX_fvstetglu[e]
Warning: Model already has the same reaction you tried to add: EX_glc3meacp[e]
Warning: Model already has the same reaction you tried to add: EX_glz[e]
Warning: Model already has the same reaction you tried to add: EX_gtacmp[e]
Warning: Model already has the same reaction you tried to add: EX_ibup_R[e]
Warning: Model already has the same reaction you tried to add: EX_ibup_S[e]
Warning: Model already has the same reaction you tried to add: EX_ibupgluc[e]
Warning: Model already has the same reaction you tried to add: EX_isolvstacid[e]
Warning: Model already has the same reaction you tried to add: EX_lst4exp[e]
Warning: Model already has the same reaction you tried to add: EX_lstn[e]
Warning: Model already has the same reaction you tried to add: EX_lstn1gluc[e]
Warning: Model already has the same reaction you tried to add: EX_lstnm1[e]
Warning: Model already has the same reaction you tried to add: EX_lstnm2[e]
Warning: Model already has the same reaction you tried to add: EX_lstnm4[e]
Warning: Model already has the same reaction you tried to add: EX_lstnm5[e]
Warning: Model already has the same reaction you tried to add: EX_lstnm7[e]
Warning: Model already has the same reaction you tried to add: EX_lvst[e]
Warning: Model already has the same reaction you tried to add: EX_mdz[e]
Warning: Model already has the same reaction you tried to add: EX_mdzglc[e]
```

```
Warning: Model already has the same reaction you tried to add: EX_meracmp[e]
Warning: Model already has the same reaction you tried to add: EX_mhglz[e]
Warning: Model already has the same reaction you tried to add: EX_ndersv[e]
Warning: Model already has the same reaction you tried to add: EX_nfd[e]
Warning: Model already has the same reaction you tried to add: EX_nfdac[e]
Warning: Model already has the same reaction you tried to add: EX_nfdlac[e]
Warning: Model already has the same reaction you tried to add: EX_nfdnpy[e]
Warning: Model already has the same reaction you tried to add: EX_nfdoh[e]
Warning: Model already has the same reaction you tried to add: EX_oxyp[e]
Warning: Model already has the same reaction you tried to add: EX_oxyp1rb[e]
Warning: Model already has the same reaction you tried to add: EX_oxyp7rb[e]
Warning: Model already has the same reaction you tried to add: EX_profvs[e]
Warning: Model already has the same reaction you tried to add: EX_ptvst[e]
Warning: Model already has the same reaction you tried to add: EX_ptvstlac[e]
Warning: Model already has the same reaction you tried to add: EX_ptvstm3[e]
Warning: Model already has the same reaction you tried to add: EX_pvs[e]
Warning: Model already has the same reaction you tried to add: EX_pvsgluc[e]
Warning: Model already has the same reaction you tried to add: EX_rsv[e]
Warning: Model already has the same reaction you tried to add: EX_rsvlac[e]
Warning: Model already has the same reaction you tried to add: EX_s3meacmp[e]
Warning: Model already has the same reaction you tried to add: EX_smv[e]
Warning: Model already has the same reaction you tried to add: EX_smvacid[e]
Warning: Model already has the same reaction you tried to add: EX_stacmp[ev]
Warning: Model already has the same reaction you tried to add: EX_sulpacmp[e]
Warning: Model already has the same reaction you tried to add: EX_tacr[e]
Warning: Model already has the same reaction you tried to add: EX_tauribup_S[e]
Warning: Model already has the same reaction you tried to add: EX_thrfvs[e]
Warning: Model already has the same reaction you tried to add: EX_tlacfvs[e]
Warning: Model already has the same reaction you tried to add: EX_tmd[e]
Warning: Model already has the same reaction you tried to add: EX_tmdm1[e]
Warning: Model already has the same reaction you tried to add: EX_tmdm3[e]
Warning: Model already has the same reaction you tried to add: EX_tmdm5[e]
Warning: Model already has the same reaction you tried to add: EX_tripvs[e]
Warning: Model already has the same reaction you tried to add: EX_tsacmgluc[e]
Warning: Model already has the same reaction you tried to add: EX_tsacmsul[e]
```

```
DM_fvsgluc[r] fvsgluc[r]  ->
DM_fvstet[r] fvstet[r]  ->
DM_fvstetglu[r] fvstetglu[r]  ->
DM_fvstetglu[c] fvstetglu[c]  ->
DM_fvstet[c] fvstet[c]  ->
DM_tlacfvs[r] tlacfvs[r]  ->
DM_fvs[c] fvs[c]  ->
DM_3meacmp[r] 3meacmp[r]  ->
DM_glc3meacp[r] glc3meacp[r]  ->
DM_glc3meacp[c] glc3meacp[c]  ->
DM_tmacmp[r] tmacmp[r]  ->
DM_gtacmp[r] gtacmp[r]  ->
DM_gtacmp[c] gtacmp[c]  ->
DM_ibupgluc[c] ibupgluc[c]  ->
DM_ibup_S[r] ibup_S[r]  ->
DM_ibupgluc[r] ibupgluc[r]  ->
DM_ibup_R[c] ibup_R[c]  ->
DM_ibupcoa_R[c] ibupcoa_R[c]  ->
DM_ibup_R[r] ibup_R[r]  ->
DM_2hibup_R[r] 2hibup_R[r]  ->
DM_3hibup_R[r] 3hibup_R[r]  ->
DM_ibupcoa_S[c] ibupcoa_S[c]  ->
DM_ibup_S[c] ibup_S[c]  ->
DM_tauribup_S[c] tauribup_S[c]  ->
DM_isolvstacid[c] isolvstacid[c]  ->
DM_lst4exp[c] lst4exp[c]  ->
```

```
DM_lstn[r] lstn[r]  ->
DM_lst4exp[r] lst4exp[r]  ->
DM_lstn1gluc[r] lstn1gluc[r]  ->
DM_lstn1gluc[c] lstn1gluc[c]  ->
DM_lstn[c] lstn[c]  ->
DM_lstnm1[r] lstnm1[r]  ->
DM_lstnm1[c] lstnm1[c]  ->
DM_lstnm2[r] lstnm2[r]  ->
DM_lstnm2[c] lstnm2[c]  ->
DM_lstnm4[r] lstnm4[r]  ->
DM_lstnm4[c] lstnm4[c]  ->
DM_lstnm5[r] lstnm5[r]  ->
DM_lstnm5[c] lstnm5[c]  ->
DM_lstnm7[c] lstnm7[c]  ->
DM_lstnm7[r] lstnm7[r]  ->
DM_lvstacid[c] lvstacid[c]  ->
DM_lvst[c] lvst[c]  ->
Warning: Model already has the same reaction you tried to add: EX_lvstacid[e]
DM_lvstacid[r] lvstacid[r]  ->
DM_6hlvstacid[r] 6hlvstacid[r]  ->
DM_6melvacid[r] 6melvacid[r]  ->
DM_lvst[r] lvst[r]  ->
DM_3hlvst[r] 3hlvst[r]  ->
DM_6hlvst[r] 6hlvst[r]  ->
DM_6melvst[r] 6melvst[r]  ->
DM_mdzglc[c] mdzglc[c]  ->
DM_mdz[c] mdz[c]  ->
DM_mhglz[c] mhglz[c]  ->
DM_rsv[r] rsv[r]  ->
DM_ndersv[r] ndersv[r]  ->
DM_ndersv[c] ndersv[c]  ->
DM_nfdac[r] nfdac[r]  ->
DM_nfdoh[r] nfdoh[r]  ->
DM_nfdac[c] nfdac[c]  ->
DM_nfdnpy[r] nfdnpy[r]  ->
DM_nfdoh[c] nfdoh[c]  ->
DM_nfdlac[c] nfdlac[c]  ->
DM_nfdnpy[c] nfdnpy[c]  ->
DM_nfd[c] nfd[c]  ->
DM_udprib[c] udprib[c]  ->
DM_oxy1rb[c] oxy1rb[c]  ->
DM_oxy7rb[c] oxy7rb[c]  ->
DM_fvscoa[x] fvscoa[x]  ->
DM_profvscoa[x] profvscoa[x]  ->
DM_profvscoa[c] profvscoa[c]  ->
DM_profvs[c] profvs[c]  ->
DM_ptvst[c] ptvst[c]  ->
DM_ptvst[r] ptvst[r]  ->
DM_ptvstgluc[r] ptvstgluc[r]  ->
DM_ptvstlac[r] ptvstlac[r]  ->
DM_ptvstlac[c] ptvstlac[c]  ->
DM_ptvstm13[r] ptvstm13[r]  ->
DM_ptvstm3[c] ptvstm3[c]  ->
DM_ptvstm3[r] ptvstm3[r]  ->
DM_pvsgluc[r] pvsgluc[r]  ->
DM_pvsgluc[c] pvsgluc[c]  ->
DM_rsv[c] rsv[c]  ->
DM_rsvgluc[r] rsvgluc[r]  ->
DM_rsvlac[r] rsvlac[r]  ->
DM_rsvlac[c] rsvlac[c]  ->
DM_s3meacmp[c] s3meacmp[c]  ->
DM_smvacid[c] smvacid[c]  ->
DM_simvgluc[r] simvgluc[r]  ->
DM_smvacid[r] smvacid[r]  ->
DM_smv[c] smv[c]  ->
DM_tmacmp[c] tmacmp[c]  ->
DM_stacmp[c] stacmp[c]  ->
```

```
DM_tacr[c] tacr[c]  ->
DM_thrfvs[c] thrfvs[c]  ->
DM_thsacmp[r] thsacmp[r]  ->
DM_tlacfvs[c] tlacfvs[c]  ->
DM_tmdm1[c] tmdm1[c]  ->
DM_tmd[r] tmd[r]  ->
DM_tmdm1[r] tmdm1[r]  ->
DM_tmdm3[c] tmdm3[c]  ->
DM_tmdm3[r] tmdm3[r]  ->
DM_tmdm5[c] tmdm5[c]  ->
DM_tmdm5[r] tmdm5[r]  ->
DM_tmd[c] tmd[c]  ->
DM_tripvs[c] tripvs[c]  ->
DM_tsacmgluc[c] tsacmgluc[c]  ->
DM_tsacmgluc[r] tsacmgluc[r]  ->
DM_thsacmp[c] thsacmp[c]  ->
DM_tsacmsul[c] tsacmsul[c]  ->
DM_3hpvscoa[c] 3hpvscoa[c]  ->
DM_3hpvstetcoa[c] 3hpvstetcoa[c]  ->
DM_fvscoa[c] fvscoa[c]  ->
DM_mdzglc[r] mdzglc[r]  ->
DM_ptvstm13[c] ptvstm13[c]  ->
Warning: Model already has the same reaction you tried to add: EX_ptvstm13[e]

DM_acmpglut[r] acmpglut[r]  ->
DM_cysacmp[r] cysacmp[r]  ->
DM_gly[r] gly[r]  ->
DM_napqi[r] napqi[r]  ->
DM_paps[r] paps[r]  ->
DM_pap[r] pap[r]  ->
Warning: Model already has the same reaction you tried to add: EX_caproic[e]

DM_1a25dhvitd2[c] 1a25dhvitd2[c]  ->
Warning: Model already has the same reaction you tried to add: EX_1a25dhvitd2[e]
Warning: Model already has the same reaction you tried to add: DM_PROTEIN

DM_h[i] h[i]  ->
TestRxnNum = 7534

DM_10fthf5glu[e] not in model
DM_10fthf6glu[e] not in model
DM_10fthf7glu[e] not in model
DM_10fthf[e] not in model
DM_11_cis_retfa[c] not in model
DM_11_cis_retfa[e] not in model
DM_11docrtsl[e] not in model
DM_11docrtstrn[e] not in model
DM_12HPET[e] not in model
DM_12dgr120[e] not in model
DM_12dhchol[e] not in model
DM_12harachd[e] not in model
DM_12htacr[e] not in model
DM_12ppd_R[e] not in model
DM_1331tacr[e] not in model
DM_13_cis_oretn[n] not in model
DM_13_cis_retn[e] not in model
DM_13_cis_retn[n] not in model
DM_13_cis_retnglc[e] not in model
DM_13dampp[e] not in model
DM_13dmt[e] not in model
DM_14hmdz[e] not in model
DM_1513tacr[e] not in model
DM_1531tacr[e] not in model
DM_15HPET[e] not in model
DM_15dmt[e] not in model
DM_15kprostgf2[e] not in model
DM_17ahprgnlone[e] not in model
DM_17ahprgstrn[e] not in model
DM_18harachd[e] not in model
DM_1a25dhvitd2[e] not in model
```

DM_1a25dhvitd3[e] not in model
DM_1glyc_hs[e] not in model
DM_1hibup_S[e] not in model
DM_1hibupglu_S[e] not in model
DM_1hmdgluc[e] not in model
DM_1mncam[e] not in model
DM_1ohmdz[e] not in model
DM_21hprgnlone[e] not in model
DM_23cump[e] not in model
DM_2425dhvitd2[e] not in model
DM_2425dhvitd3[e] not in model
DM_24nph[e] not in model
DM_25hvitd2[c] not in model
DM_25hvitd2[e] not in model
DM_25hvitd3[e] not in model
DM_2h3mv[e] not in model
DM_2hatvacid[e] not in model
DM_2hatvacidgluc[e] not in model
DM_2hatvlac[e] not in model
DM_2hatvlacgluc[e] not in model
DM_2hb[e] not in model
DM_2hibup_R[e] not in model
DM_2hibup_S[e] not in model
DM_2hibupglu_S[e] not in model
DM_2hiv[e] not in model
DM_2hyoxplac[e] not in model
DM_2m3hbu[e] not in model
DM_2m3hvac[e] not in model
DM_2mcit[e] not in model
DM_2obut[e] not in model
DM_2oxoadp[e] not in model
DM_2pg[e] not in model
DM_31dmt[e] not in model
DM_34dhoxmand[e] not in model
DM_34dhoxpeg[e] not in model
DM_34dhpac[c] not in model
DM_34dhpe[e] not in model
DM_34dhpha[e] not in model
DM_34dhphe[e] not in model
DM_34hpl[e] not in model
DM_34hpp[e] not in model
DM_35cgmp[e] not in model
DM_35dhpvs[e] not in model
DM_35diotyr[e] not in model
DM_35dsmv[e] not in model
DM_3aib[e] not in model
DM_3aib_D[e] not in model
DM_3bcrn[e] not in model
DM_3ddcrn[e] not in model
DM_3deccrn[e] not in model
DM_3dhcdchol[e] not in model
DM_3dhchol[e] not in model
DM_3dhdchol[e] not in model
DM_3dhlchol[e] not in model
DM_3h3mglt[e] not in model
DM_3hadpac[e] not in model
DM_3hanthrn[e] not in model
DM_3hdececrn[e] not in model
DM_3hexdcrn[e] not in model
DM_3hibup_R[e] not in model
DM_3hibup_S[e] not in model
DM_3hibupglu_S[e] not in model
DM_3hivac[e] not in model
DM_3hlvstacid[e] not in model
DM_3hmp[e] not in model
DM_3hpp[e] not in model
DM_3hpppn[e] not in model
DM_3hpppnohgluc[e] not in model

DM_3hpvs[e] not in model
DM_3hpvstet[e] not in model
DM_3hsmvacid[e] not in model
DM_3ispvs[e] not in model
DM_3ityr_L[e] not in model
DM_3ivcrn[e] not in model
DM_3mglutac[e] not in model
DM_3mglutr[e] not in model
DM_3mhis[e] not in model
DM_3mlda[e] not in model
DM_3mob[e] not in model
DM_3mop[e] not in model
DM_3mox4hoxm[e] not in model
DM_3moxtyr[e] not in model
DM_3mtp[e] not in model
DM_3octdec2crn[e] not in model
DM_3octdeccrn[e] not in model
DM_3octdece1crn[e] not in model
DM_3ohacmp[e] not in model
DM_3ohglutac[e] not in model
DM_3ohsebac[e] not in model
DM_3ohsubac[e] not in model
DM_3pg[e] not in model
DM_3tdcrn[e] not in model
DM_3tetd7ecoacrn[e] not in model
DM_3thexddcoacrn[e] not in model
DM_3ttetddcoacrn[e] not in model
DM_3uib[e] not in model
DM_3ump[e] not in model
DM_4aabutn[e] not in model
DM_4abut[e] not in model
DM_4abut[l] not in model
DM_4abutn[e] not in model
DM_4bhglz[e] not in model
DM_4glu56dihdind[e] not in model
DM_4hatvacid[e] not in model
DM_4hatvlac[e] not in model
DM_4hbz[e] not in model
DM_4hdebrisoquine[e] not in model
DM_4hmdgluc[e] not in model
DM_4hphac[e] not in model
DM_4hpro_LT[e] not in model
DM_4hpro_LT[m] not in model
DM_4mop[e] not in model
DM_4mptnl[e] not in model
DM_4mtolbutamide[e] not in model
DM_4nph[e] not in model
DM_4nphsf[e] not in model
DM_4ohbut[e] not in model
DM_4ohmdz[e] not in model
DM_4pyrdx[e] not in model
DM_4tmeabutn[e] not in model
DM_56dhpvs[e] not in model
DM_56dthm[e] not in model
DM_56dura[e] not in model
DM_56eppvs[e] not in model
DM_5HPET[c] not in model
DM_5HPET[e] not in model
DM_5HPET[r] not in model
DM_5a2opntn[e] not in model
DM_5adtststerone[e] not in model
DM_5adtststeroneglc[e] not in model
DM_5adtststerones[e] not in model
DM_5aop[e] not in model
DM_5cysdopa[e] not in model
DM_5cysgly34dhphe[e] not in model
DM_5dhf[e] not in model
DM_5eipenc[e] not in model

DM_5fthf[e] not in model
DM_5g2oxpt[e] not in model
DM_5homeprazole[e] not in model
DM_5hoxindoa[e] not in model
DM_5htrp[e] not in model
DM_5mta[e] not in model
DM_5mthf[e] not in model
DM_5ohfvs[e] not in model
DM_5ohfvsglu[e] not in model
DM_5ohhexa[e] not in model
DM_5oxpro[e] not in model
DM_5thf[e] not in model
DM_6ahglz[e] not in model
DM_6bhglz[e] not in model
DM_6bhglzglc[e] not in model
DM_6csmvacid[e] not in model
DM_6dhf[e] not in model
DM_6epvs[e] not in model
DM_6hlvst[e] not in model
DM_6hmsmvacid[e] not in model
DM_6hoxmelatn[e] not in model
DM_6hsmvacid[e] not in model
DM_6htststerone[e] not in model
DM_6melvacid[e] not in model
DM_6melvst[e] not in model
DM_6ohfvs[e] not in model
DM_6ohfvsglu[e] not in model
DM_6thf[e] not in model
DM_7ahglz[e] not in model
DM_7bhglz[e] not in model
DM_7bhglzglc[e] not in model
DM_7dhcdchol[e] not in model
DM_7dhchol[e] not in model
DM_7dhchsterol[e] not in model
DM_7dhf[e] not in model
DM_7hpvs[e] not in model
DM_7klitchol[c] not in model
DM_7klitchol[e] not in model
DM_7ohocata[e] not in model
DM_7thf[e] not in model
DM_9_cis_retfa[c] not in model
DM_9_cis_retfa[e] not in model
DM_Asn_X_Ser_Thr[l] not in model
DM_C01601[e] not in model
DM_C02356[e] not in model
DM_C02470[e] not in model
DM_C02528[c] not in model
DM_C02528[e] not in model
DM_C02712[e] not in model
DM_C03681[e] not in model
DM_C04717[e] not in model
DM_C04805[e] not in model
DM_C04849[e] not in model
DM_C05298[e] not in model
DM_C05299[e] not in model
DM_C05300[e] not in model
DM_C05301[e] not in model
DM_C05302[e] not in model
DM_C05767[e] not in model
DM_C05769[e] not in model
DM_C05770[e] not in model
DM_C05957[e] not in model
DM_C06314[e] not in model
DM_C06315[e] not in model
DM_C09642[e] not in model
DM_C10164[e] not in model
DM_C11695[e] not in model
DM_C13856[e] not in model

DM_C14768[e] not in model
DM_C14769[e] not in model
DM_C14770[e] not in model
DM_C14771[e] not in model
DM_C14825[e] not in model
DM_C14826[e] not in model
DM_CE0074[e] not in model
DM_CE0737[e] not in model
DM_CE0955[e] not in model
DM_CE1243[e] not in model
DM_CE1261[e] not in model
DM_CE1273[c] not in model
DM_CE1273[e] not in model
DM_CE1310[e] not in model
DM_CE1352[e] not in model
DM_CE1401[e] not in model
DM_CE1447[e] not in model
DM_CE1556[e] not in model
DM_CE1617[e] not in model
DM_CE1918[e] not in model
DM_CE1925[e] not in model
DM_CE1926[e] not in model
DM_CE1935[e] not in model
DM_CE1936[e] not in model
DM_CE1939[e] not in model
DM_CE1940[e] not in model
DM_CE1943[e] not in model
DM_CE1950[e] not in model
DM_CE2006[e] not in model
DM_CE2026[e] not in model
DM_CE2028[e] not in model
DM_CE2047[e] not in model
DM_CE2049[e] not in model
DM_CE2172[e] not in model
DM_CE2176[e] not in model
DM_CE2209[e] not in model
DM_CE2211[e] not in model
DM_CE2250[e] not in model
DM_CE2445[e] not in model
DM_CE2510[e] not in model
DM_CE2537[e] not in model
DM_CE2705[e] not in model
DM_CE2838[e] not in model
DM_CE2839[e] not in model
DM_CE2915[e] not in model
DM_CE2916[e] not in model
DM_CE2917[e] not in model
DM_CE2934[e] not in model
DM_CE4633[e] not in model
DM_CE4722[e] not in model
DM_CE4723[e] not in model
DM_CE4724[e] not in model
DM_CE4877[e] not in model
DM_CE4881[e] not in model
DM_CE4890[e] not in model
DM_CE4968[e] not in model
DM_CE4969[e] not in model
DM_CE4970[e] not in model
DM_CE5025[e] not in model
DM_CE5026[e] not in model
DM_CE5072[e] not in model
DM_CE5304[e] not in model
DM_CE5629[e] not in model
DM_CE5643[e] not in model
DM_CE5786[e] not in model
DM_CE5787[e] not in model
DM_CE5788[e] not in model
DM_CE5789[e] not in model

DM_CE5791[e] not in model
DM_CE5797[e] not in model
DM_CE5798[e] not in model
DM_CE5853[e] not in model
DM_CE5854[e] not in model
DM_CE5867[e] not in model
DM_CE5868[e] not in model
DM_CE5869[e] not in model
DM_CE6031[e] not in model
DM_CE6205[e] not in model
DM_CE6247[e] not in model
DM_CE7081[e] not in model
DM_CE7082[e] not in model
DM_CE7083[e] not in model
DM_CE7085[e] not in model
DM_CE7090[e] not in model
DM_CE7096[e] not in model
DM_CE7172[e] not in model
DM_HC00004[e] not in model
DM_HC00005[e] not in model
DM_HC00006[e] not in model
DM_HC00007[e] not in model
DM_HC00008[e] not in model
DM_HC00009[e] not in model
DM_HC00250[e] not in model
DM_HC00342[e] not in model
DM_HC00460[e] not in model
DM_HC00822[e] not in model
DM_HC00900[e] not in model
DM_HC00955[e] not in model
DM_HC01104[e] not in model
DM_HC01361[e] not in model
DM_HC01440[e] not in model
DM_HC01441[e] not in model
DM_HC01444[e] not in model
DM_HC01446[e] not in model
DM_HC01577[e] not in model
DM_HC01609[e] not in model
DM_HC01700[e] not in model
DM_HC02020[e] not in model
DM_HC02160[e] not in model
DM_HC02161[e] not in model
DM_HC02180[e] not in model
DM_HC02187[e] not in model
DM_HC02191[c] not in model
DM_HC02191[e] not in model
DM_HC02192[c] not in model
DM_HC02192[e] not in model
DM_HC02193[c] not in model
DM_HC02193[e] not in model
DM_HC02194[c] not in model
DM_HC02194[e] not in model
DM_HC02195[c] not in model
DM_HC02195[e] not in model
DM_HC02196[c] not in model
DM_HC02196[e] not in model
DM_HC02197[c] not in model
DM_HC02197[e] not in model
DM_HC02198[c] not in model
DM_HC02198[e] not in model
DM_HC02202[e] not in model
DM_HC02203[e] not in model
DM_HC02204[e] not in model
DM_HC02205[e] not in model
DM_HC02206[e] not in model
DM_HC02207[e] not in model

```
ObjValue = -1.0648e-10
```

```
TableChecks{cnt,1} = 'fastLeakTest 2 - add demand reactions for each metabolite in the model';
if length(LeakRxnsDM)>0
    TableChecks{cnt,2} = 'Model leaks metabolites when demand reactions are added!';
else
    TableChecks{cnt,2} = 'Leak free when demand reactions are added!';
end
cnt = cnt + 1;
```

Test if the model produces energy from water!

```
modelClosed = modelClosedOri;
modelClosedATP = changeObjective(modelClosed,'DM_atp_c_');
modelClosedATP = changeRxnBounds(modelClosedATP,'DM_atp_c_',0,'l');
modelClosedATP = changeRxnBounds(modelClosedATP,'EX_h2o[e]',-1,'l');
FBA3=optimizeCbModel(modelClosedATP);
TableChecks{cnt,1} = 'Exchanges, sinks, and demands have  lb = 0, except h2o';
if abs(FBA3.f) > 1e-6
    TableChecks{cnt,2} = 'model produces energy from water!';
else
    TableChecks{cnt,2} = 'model DOES NOT produce energy from water!';
end
cnt = cnt + 1;
```

Test if the model produces energy from water and oxygen!

```
modelClosed = modelClosedOri;
modelClosedATP = changeObjective(modelClosed,'DM_atp_c_');
modelClosedATP = changeRxnBounds(modelClosedATP,'DM_atp_c_',0,'l');
modelClosedATP = changeRxnBounds(modelClosedATP,'EX_h2o[e]',-1,'l');
modelClosedATP = changeRxnBounds(modelClosedATP,'EX_o2[e]',-1,'l');

FBA6=optimizeCbModel(modelClosedATP);
TableChecks{cnt,1} = 'Exchanges, sinks, and demands have  lb = 0, except h2o and o2';
if abs(FBA6.f) > 1e-6
    TableChecks{cnt,2} = 'model produces energy from water and oxygen!';
else
    TableChecks{cnt,2} = 'model DOES NOT produce energy from water and oxygen!';
end
cnt = cnt + 1;
```

Test if the model produces matter when atp demand is reversed!

```
modelClosed = modelClosedOri;
modelClosed = changeObjective(modelClosed,'DM_atp_c_');
modelClosed.lb(find(ismember(modelClosed.rxns,'DM_atp_c_'))) = -1000;
FBA = optimizeCbModel(modelClosed);
TableChecks{cnt,1} = 'Exchanges, sinks, and demands have  lb = 0, allow DM_atp_c_ to be revers
if abs(FBA.f) > 1e-6
    TableChecks{cnt,2} = 'model produces matter when atp demand is reversed!';
else
    TableChecks{cnt,2} = 'model DOES NOT produce matter when atp demand is reversed!';
end
cnt = cnt + 1;
```

Test if the model has flux through h[m] demand !

```
modelClosed = modelClosedOri;
modelClosed = addDemandReaction(modelClosed,'h[m]');
```

```
DM_h[m] h[m]  ->
```

```
modelClosed = changeObjective(modelClosed,'DM_h[m]');
modelClosed.ub(find(ismember(modelClosed.rxns,'DM_h[m]'))) = 1000;
FBA = optimizeCbModel(modelClosed,'max');
TableChecks{cnt,1} = 'Exchanges, sinks, and demands have  lb = 0, test flux through DM_h[m] (m
if abs(FBA.f) > 1e-6
    TableChecks{cnt,2} = 'model has flux through h[m] demand (max)!';
else
    TableChecks{cnt,2} = 'model has NO flux through h[m] demand (max)!';
end
cnt = cnt + 1;
```

Test if the model has flux through h[c] demand !

```
modelClosed = modelClosedOri;
modelClosed = addDemandReaction(modelClosed,'h[c]');
```

```
DM_h[c] h[c]  ->
```

```
modelClosed = changeObjective(modelClosed,'DM_h[c]');
modelClosed.ub(find(ismember(modelClosed.rxns,'DM_h[c]'))) = 1000;
FBA = optimizeCbModel(modelClosed,'max');
TableChecks{cnt,1} = 'Exchanges, sinks, and demands have  lb = 0, test flux through DM_h[c] (m
if abs(FBA.f) > 1e-6
    TableChecks{cnt,2} = 'model has flux through h[c] demand (max)!';
else
    TableChecks{cnt,2} = 'model has NO flux through h[c] demand (max)!';
end
cnt = cnt + 1;
```

Test if the model produces too much atp demand from glucose under aerobic condition. Also consider using the tutorial testModelATPYield to test if the correct ATP yield from different carbon sources can be realized by the model.

```
modelClosed = modelClosedOri;
modelClosed = changeObjective(modelClosed,'DM_atp_c_');
modelClosed.lb(find(ismember(modelClosed.rxns,'EX_o2[e]'))) = -1000;
modelClosed.lb(find(ismember(modelClosed.rxns,'EX_h2o[e]'))) = -1000;
modelClosed.ub(find(ismember(modelClosed.rxns,'EX_h2o[e]'))) = 1000;
modelClosed.ub(find(ismember(modelClosed.rxns,'EX_co2[e]'))) = 1000;
FBAOri = optimizeCbModel(modelClosed,'max');

TableChecks{cnt,1} = 'ATP yield ';
if abs(FBAOri.f) > 31 % this is the theoretical value
     TableChecks{cnt,2} = 'model produces too much atp demand from glc!';
else
   TableChecks{cnt,2} ='model DOES NOT produce too much atp demand from glc!';
end
cnt = cnt + 1;
```

Test metabolic objective functions with open sinks. Note this step is time consuming and may only work reliably on Recon 3D derived models due to different usage of abbreviations.

```
TableChecks{cnt,1} = 'Test metabolic objective functions with open sinks';
if 1 % perform test function
    [TestSolution,TestSolutionNameOpenSinks, TestedRxnsSinks, PercSinks] = Test4HumanFctExt(mo
    TableChecks{cnt,2} = strcat('Done. See variable TestSolutionNameOpenSinks for results. The
else
    TableChecks{cnt,2} = 'Not performed.';
end
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_gly(c) gly(c)  <=>
sink_co2(c) co2(c)  ->
sink_nh4(c) nh4(c)  ->
sink_12ppd-S(c) 12ppd-S(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_12ppd-S(c) 12ppd-S(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_3pg(c) 3pg(c)  <=>
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_gly(c) gly(c)  ->
sink_3pg(c) 3pg(c)  <=>
sink_ser-L(c) ser-L(c)  ->
sink_4abut(c) 4abut(c)  <=>
sink_succ(m) succ(m)  ->
sink_4hpro-LT(m) 4hpro-LT(m)  <=>
sink_glx(m) glx(m)  ->
sink_5aop(c) 5aop(c)  <=>
sink_pheme(c) pheme(c)  ->
sink_aact(c) aact(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_acac(m) acac(m)  <=>
sink_acetone(m) acetone(m)  ->
sink_acac(m) acac(m)  <=>
sink_bhb(m) bhb(m)  ->
sink_acald(c) acald(c)  <=>
sink_ac(c) ac(c)  ->
sink_accoa(c) accoa(c)  <=>
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_pmtcoa(c) pmtcoa(c)  ->
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_pmtcoa(c) pmtcoa(c)  <=>
sink_malcoa(m) malcoa(m)  ->
sink_acetone(c) acetone(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_acgal(c) acgal(c)  <=>
sink_udpacgal(c) udpacgal(c)  ->
sink_acgam(c) acgam(c)  <=>
sink_cmpacna(c) cmpacna(c)  ->
sink_acorn(c) acorn(c)  <=>
sink_orn(c) orn(c)  ->
sink_adrnl(c) adrnl(c)  <=>
sink_34dhoxpeg(c) 34dhoxpeg(c)  ->
sink_akg(m) akg(m)  <=>
sink_oaa(m) oaa(m)  ->
sink_akg(m) akg(m)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_akg(m) akg(m)  <=>
sink_ala-B(c) ala-B(c)  <=>
sink_msa(m) msa(m)  ->
sink_ala-D(c) ala-D(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_ala-L(c) ala-L(c)  <=>
sink_ala-D(c) ala-D(c)  ->
sink_ala-L(c) ala-L(c)  <=>
sink_pyr(c) pyr(c)  ->
```

```
sink_arachd(c) arachd(c)  <=>
sink_malcoa(m) malcoa(m)  ->
sink_arachd(r) arachd(r)  <=>
sink_txa2(r) txa2(r)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_creat(c) creat(c)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_no(c) no(c)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_pcreat(c) pcreat(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
Warning: Metabolite eryth(c) not in model - added to the model
sink_eryth(c) eryth(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
Warning: Metabolite lyxnt(c) not in model - added to the model
sink_lyxnt(c) lyxnt(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
sink_thrnt(c) thrnt(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
Warning: Metabolite xylnt(c) not in model - added to the model
sink_xylnt(c) xylnt(c)  ->
sink_asn-L(c) asn-L(c)  <=>
sink_oaa(c) oaa(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_hco3(c) hco3(c)  <=>
sink_arg-L(c) arg-L(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_asn-L(c) asn-L(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_argsuc(c) argsuc(c)  ->
sink_argsuc(c) argsuc(c)  <=>
sink_fum(c) fum(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_dcamp(c) dcamp(c)  ->
sink_dcamp(c) dcamp(c)  <=>
sink_fum(c) fum(c)  ->
sink_dcamp(c) dcamp(c)  <=>
sink_fum(c) fum(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_oaa(c) oaa(c)  ->
sink_carn(c) carn(c)  <=>
sink_ala-B(c) ala-B(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_chol(c) chol(c)  <=>
sink_dag_hs(c) dag_hs(c)  <=>
sink_pe_hs(c) pe_hs(c)  ->
sink_chol(m) chol(m)  <=>
sink_glyb(m) glyb(m)  ->
sink_glyb(m) glyb(m)  <=>
sink_gly(m) gly(m)  ->
sink_coke(r) coke(r)  <=>
Warning: Metabolite pecgoncoa(r) not in model - added to the model
sink_pecgoncoa(r) pecgoncoa(r)  ->
sink_core2(g) core2(g)  <=>
sink_ksii_core2(g) ksii_core2(g)  ->
sink_core4(g) core4(g)  <=>
sink_ksii_core4(g) ksii_core4(g)  ->
sink_cspg_a(l) cspg_a(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
```

```
sink_cspg_b(l) cspg_b(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_c(l) cspg_c(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_d(l) cspg_d(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_e(l) cspg_e(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_glu-L(c) glu-L(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_gthrd(c) gthrd(c)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_3sala(c) 3sala(c)  ->
sink_3sala(c) 3sala(c)  <=>
sink_so4(c) so4(c)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_hyptaur(c) hyptaur(c)  ->
sink_Lcystin(c) Lcystin(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_dhap(c) dhap(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dmpp(c) dmpp(c)  <=>
Warning: Metabolite ggdp(c) not in model - added to the model
sink_ggdp(c) ggdp(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite dna(n) not in model - added to the model
sink_dna(n) dna(n)  <=>
Warning: Metabolite dna5mtc(n) not in model - added to the model
sink_dna5mtc(n) dna5mtc(n)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_L(c) dolichol_L(c)  <=>
Warning: Metabolite dolmanp_L(r) not in model - added to the model
sink_dolmanp_L(r) dolmanp_L(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_L(c) dolichol_L(c)  <=>
Warning: Metabolite g3m8mpdol_L(r) not in model - added to the model
sink_g3m8mpdol_L(r) g3m8mpdol_L(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_U(c) dolichol_U(c)  <=>
sink_dolmanp_U(r) dolmanp_U(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_U(c) dolichol_U(c)  <=>
Warning: Metabolite g3m8mpdol_U(r) not in model - added to the model
sink_g3m8mpdol_U(r) g3m8mpdol_U(r)  ->
```

```
sink_dopa(c) dopa(c)  <=>
sink_homoval(c) homoval(c)  ->
sink_etoh(c) etoh(c)  <=>
sink_acald(c) acald(c)  ->
sink_f6p(c) f6p(c)  <=>
sink_g3p(c) g3p(c)  <=>
sink_r5p(c) r5p(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_frdp(c) frdp(c)  <=>
sink_dolichol_L(r) dolichol_L(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_frdp(c) frdp(c)  <=>
sink_dolichol_U(r) dolichol_U(r)  ->
sink_ade(c) ade(c)  <=>
sink_amp(c) amp(c)  ->
sink_adn(c) adn(c)  <=>
sink_urate(x) urate(x)  ->
sink_adp(c) adp(c)  <=>
sink_datp(n) datp(n)  ->
sink_cdp(c) cdp(c)  <=>
sink_dctp(n) dctp(n)  ->
sink_cmp(c) cmp(c)  <=>
sink_cytd(c) cytd(c)  ->
sink_cytd(c) cytd(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_dcmp(c) dcmp(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_gdp(c) gdp(c)  <=>
sink_dgtp(n) dgtp(n)  ->
sink_gln-L(c) gln-L(c)  <=>
sink_hco3(c) hco3(c)  <=>
sink_ump(c) ump(c)  ->
sink_gsn(c) gsn(c)  <=>
sink_urate(x) urate(x)  ->
sink_gua(c) gua(c)  <=>
sink_gmp(c) gmp(c)  ->
sink_hxan(c) hxan(c)  <=>
sink_imp(c) imp(c)  ->
sink_imp(c) imp(c)  <=>
sink_atp(c) atp(c)  ->
sink_imp(c) imp(c)  <=>
sink_gtp(c) gtp(c)  ->
sink_imp(c) imp(c)  <=>
sink_urate(x) urate(x)  ->
sink_prpp(c) prpp(c)  <=>
sink_imp(c) imp(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pydx(c) pydx(c)  <=>
sink_pydx5p(c) pydx5p(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thm(c) thm(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_thmpp(c) thmpp(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thm(e) thm(e)  <=>
sink_thmpp(m) thmpp(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thmmp(e) thmmp(e)  <=>
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_thmpp(c) thmpp(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thmpp(m) thmpp(m)  ->
sink_tyr-L(m) tyr-L(m)  <=>
sink_q10(m) q10(m)  ->
sink_udp(c) udp(c)  <=>
sink_dttp(n) dttp(n)  ->
sink_ump(c) ump(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_fru(c) fru(c)  <=>
sink_dhap(c) dhap(c)  ->
sink_fru(c) fru(c)  <=>
sink_g3p(c) g3p(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_fuc-L(c) fuc-L(c)  <=>
sink_gdpfuc(c) gdpfuc(c)  ->
sink_fum(m) fum(m)  <=>
sink_oaa(m) oaa(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_g1p(c) g1p(c)  <=>
Warning: Metabolite dtdprmn(c) not in model - added to the model
sink_dtdprmn(c) dtdprmn(c)  ->
sink_g3p(c) g3p(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_g6p(c) g6p(c)  <=>
sink_r5p(c) r5p(c)  ->
sink_g6p(c) g6p(c)  <=>
sink_ru5p-D(c) ru5p-D(c)  ->
sink_gal(c) gal(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_gal(c) gal(c)  <=>
sink_udpgal(c) udpgal(c)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_galgalgalthcrm_hs(g) galgalgalthcrm_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_acgagbside_hs(g) acgagbside_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_acnacngalgbside_hs(g) acnacngalgbside_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gd1b2_hs(g) gd1b2_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gd1c_hs(g) gd1c_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gp1c_hs(g) gp1c_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gq1balpha_hs(g) gq1balpha_hs(g)  ->
sink_gam6p(c) gam6p(c)  <=>
sink_uacgam(c) uacgam(c)  ->
sink_gdpmann(c) gdpmann(c)  <=>
sink_gdpfuc(c) gdpfuc(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_inost(c) inost(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_lac-L(c) lac-L(c)  ->
sink_atp(c) atp(c)  ->
sink_h2o(c) h2o(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_lac-D(c) lac-D(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_lcts(g) lcts(g)  ->
sink_glc-D(c) glc-D(c)  <=>
```

```
sink_pyr(c) pyr(c)  ->
sink_gln-L(c) gln-L(c)  <=>
sink_nh4(c) nh4(c)  ->
sink_gln-L(m) gln-L(m)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_gln-L(m) gln-L(m)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_glu5sa(c) glu5sa(c)  <=>
sink_pro-L(c) pro-L(c)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_4abut(c) 4abut(c)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_gln-L(c) gln-L(c)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_pro-L(c) pro-L(c)  ->
sink_glu-L(m) glu-L(m)  <=>
sink_akg(m) akg(m)  ->
sink_gluside_hs(g) gluside_hs(g)  <=>
sink_galgluside_hs(g) galgluside_hs(g)  ->
sink_glx(m) glx(m)  <=>
sink_glyclt(m) glyclt(m)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_ser-L(c) ser-L(c)  ->
sink_ser-L(c) ser-L(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_glyc(c) glyc(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_glyc(c) glyc(c)  <=>
sink_Rtotal(c) Rtotal(c)  <=>
sink_Rtotal2(c) Rtotal2(c)  <=>
sink_dag_hs(c) dag_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_glyc(c) glyc(c)  <=>
sink_Rtotal(c) Rtotal(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_tag_hs(c) tag_hs(c)  ->
sink_glyclt(c) glyclt(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_glygn2(c) glygn2(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_glygn2(e) glygn2(e)  <=>
sink_glc-D(e) glc-D(e)  ->
sink_glx(c) glx(c)  <=>
sink_oxa(c) oxa(c)  ->
sink_ha(l) ha(l)  <=>
sink_acgam(l) acgam(l)  ->
sink_glcur(l) glcur(l)  ->
sink_his-L(c) his-L(c)  <=>
sink_glu-L(c) glu-L(c)  ->
sink_his-L(c) his-L(c)  <=>
sink_hista(c) hista(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_hista(c) hista(c)  <=>
sink_3mlda(c) 3mlda(c)  ->
sink_hista(c) hista(c)  <=>
sink_im4act(c) im4act(c)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_chsterol(r) chsterol(r)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
```

```
sink_frdp(x) frdp(x)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_xoldiolone(r) xoldiolone(r)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_xoltriol(c) xoltriol(c)  ->
sink_hpyr(c) hpyr(c)  <=>
sink_2pg(c) 2pg(c)  ->
sink_hpyr(c) hpyr(c)  <=>
sink_glyclt(c) glyclt(c)  ->
sink_hpyr(c) hpyr(c)  <=>
sink_glyc-S(c) glyc-S(c)  ->
sink_hspg(l) hspg(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_hyptaur(c) hyptaur(c)  <=>
sink_taur(x) taur(x)  ->
sink_ile-L(c) ile-L(c)  <=>
sink_accoa(c) accoa(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_inost(c) inost(c)  <=>
sink_pail_hs(c) pail_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_inost(c) inost(c)  <=>
sink_pail45p_hs(c) pail45p_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_inost(c) inost(c)  <=>
sink_pail4p_hs(c) pail4p_hs(c)  ->
sink_inost(c) inost(c)  <=>
sink_xu5p-D(c) xu5p-D(c)  ->
sink_ipdp(x) ipdp(x)  <=>
sink_sql(r) sql(r)  ->
sink_itacon(m) itacon(m)  <=>
sink_pyr(m) pyr(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_ksi(l) ksi(l)  <=>
sink_man(l) man(l)  ->
sink_acgam(l) acgam(l)  ->
sink_ksii_core2(l) ksii_core2(l)  <=>
sink_Ser/Thr(l) Ser/Thr(l)  ->
sink_ksii_core4(l) ksii_core4(l)  <=>
sink_Ser/Thr(l) Ser/Thr(l)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite l2fn2m2masn(g) not in model - added to the model
sink_l2fn2m2masn(g) l2fn2m2masn(g)  <=>
Warning: Metabolite ksi(g) not in model - added to the model
sink_ksi(g) ksi(g)  ->
sink_lac-L(c) lac-L(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_Lcyst(c) Lcyst(c)  <=>
sink_taur(x) taur(x)  ->
sink_leu-L(c) leu-L(c)  <=>
sink_accoa(c) accoa(c)  ->
sink_lys-L(c) lys-L(c)  <=>
sink_accoa(m) accoa(m)  ->
sink_lys-L(x) lys-L(x)  <=>
sink_aacoa(m) aacoa(m)  ->
Warning: Metabolite m8masn(r) not in model - added to the model
```

```
sink_m8masn(r) m8masn(r)  <=>
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  ->
sink_man(c) man(c)  <=>
sink_gdpmann(c) gdpmann(c)  ->
sink_man6p(c) man6p(c)  <=>
sink_kdn(c) kdn(c)  ->
sink_mescon(m) mescon(m)  <=>
sink_pyr(m) pyr(m)  ->
sink_met-L(c) met-L(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_mi145p(c) mi145p(c)  <=>
sink_inost(c) inost(c)  ->
sink_msa(m) msa(m)  <=>
sink_ala-B(m) ala-B(m)  ->
sink_mthgxl(c) mthgxl(c)  <=>
sink_12ppd-S(c) 12ppd-S(c)  ->
sink_mthgxl(c) mthgxl(c)  <=>
sink_lac-D(c) lac-D(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_n2m2nmasn(l) n2m2nmasn(l)  <=>
sink_man(l) man(l)  ->
sink_acgam(l) acgam(l)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  <=>
Warning: Metabolite l2fn2m2masn(g) not in model - added to the model
sink_l2fn2m2masn(g) l2fn2m2masn(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  <=>
Warning: Metabolite n2m2nmasn(g) not in model - added to the model
sink_n2m2nmasn(g) n2m2nmasn(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  <=>
Warning: Metabolite s2l2fn2m2masn(g) not in model - added to the model
sink_s2l2fn2m2masn(g) s2l2fn2m2masn(g)  ->
sink_o2s(c) o2s(c)  <=>
sink_h2o2(c) h2o2(c)  ->
sink_h2o2(c) h2o2(c)  <=>
sink_o2(c) o2(c)  <=>
sink_h2o(c) h2o(c)  ->
sink_orn(c) orn(c)  <=>
sink_nh4(c) nh4(c)  ->
sink_orn(c) orn(c)  <=>
sink_ptrc(c) ptrc(c)  ->
sink_orn(c) orn(c)  <=>
sink_spmd(c) spmd(c)  ->
sink_orn(c) orn(c)  <=>
sink_sprm(c) sprm(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_pail_hs(c) pail_hs(c)  <=>
sink_gpi_prot_hs(r) gpi_prot_hs(r)  ->
sink_pail45p_hs(c) pail45p_hs(c)  <=>
sink_mi145p(c) mi145p(c)  ->
sink_phe-L(c) phe-L(c)  <=>
```

```
sink_pac(c) pac(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_pacald(c) pacald(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_peamn(c) peamn(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_phaccoa(c) phaccoa(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_pheacgln(c) pheacgln(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_phpyr(c) phpyr(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_tyr-L(c) tyr-L(c)  ->
sink_pheme(c) pheme(c)  <=>
sink_bilirub(c) bilirub(c)  ->
sink_phytcoa(x) phytcoa(x)  <=>
sink_dmnoncoa(m) dmnoncoa(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pmtcoa(c) pmtcoa(c)  <=>
sink_crmp_hs(c) crmp_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pmtcoa(c) pmtcoa(c)  <=>
sink_sphmyln_hs(c) sphmyln_hs(c)  ->
sink_ppcoa(m) ppcoa(m)  <=>
sink_succoa(m) succoa(m)  ->
sink_pro-L(c) pro-L(c)  <=>
sink_glu-L(c) glu-L(c)  ->
sink_ptrc(c) ptrc(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_ptrc(c) ptrc(c)  <=>
sink_spmd(c) spmd(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_pyr(c) pyr(c)  <=>
sink_fadh2(m) fadh2(m)  <=>
sink_fad(m) fad(m)  ->
sink_h(m) h(m)  ->
sink_pyr(c) pyr(c)  <=>
sink_lac-D(c) lac-D(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_pyr(c) pyr(c)  <=>
sink_nad(m) nad(m)  ->
sink_h(m) h(m)  ->
sink_pyr(c) pyr(c)  <=>
sink_accoa(m) accoa(m)  ->
sink_nadh(m) nadh(m)  ->
sink_co2(c) co2(c)  ->
sink_pyr(c) pyr(c)  <=>
sink_ala-L(c) ala-L(c)  ->
sink_ala-L(c) ala-L(c)  <=>
sink_pyr(c) pyr(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_s2l2fn2m2masn(l) s2l2fn2m2masn(l)  <=>
sink_man(l) man(l)  ->
sink_acgam(l) acgam(l)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_core2(g) core2(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_core4(g) core4(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_Tn_antigen(g) Tn_antigen(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_sTn_antigen(g) sTn_antigen(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cs_pre(g) cs_pre(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_a(g) cspg_a(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_c(g) cspg_c(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_d(g) cspg_d(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_e(g) cspg_e(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_hspg(g) hspg(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_b(g) cspg_b(g)  ->
sink_ser-L(c) ser-L(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_so4(c) so4(c)  <=>
sink_paps(c) paps(c)  ->
sink_spmd(c) spmd(c)  <=>
sink_sprm(c) sprm(c)  ->
sink_srtn(c) srtn(c)  <=>
Warning: Metabolite f5hoxkyn(c) not in model - added to the model
```

```
sink_f5hoxkyn(c) f5hoxkyn(c)  ->
sink_srtn(c) srtn(c)  <=>
sink_fna5moxam(c) fna5moxam(c)  ->
sink_srtn(c) srtn(c)  <=>
Warning: Metabolite nmthsrtn(c) not in model - added to the model
```

```
sink_nmthsrtn(c) nmthsrtn(c)  ->
sink_succoa(m) succoa(m)  <=>
sink_oaa(m) oaa(m)  ->
sink_taur(x) taur(x)  <=>
sink_tchola(x) tchola(x)  ->
sink_thcholstoic(x) thcholstoic(x)  <=>
sink_gchola(x) gchola(x)  ->
sink_thcholstoic(x) thcholstoic(x)  <=>
sink_tchola(x) tchola(x)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_ppcoa(c) ppcoa(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_accoa(c) accoa(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_anth(c) anth(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_id3acald(c) id3acald(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_kynate(c) kynate(c)  ->
```

```
sink_trp-L(c) trp-L(c)  <=>
sink_melatn(c) melatn(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_Lfmkynr(c) Lfmkynr(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_Lkynr(c) Lkynr(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_nformanth(c) nformanth(c)  ->
sink_srtn(c) srtn(c)  <=>
Warning: Metabolite 5moxact(c) not in model - added to the model
sink_5moxact(c) 5moxact(c)  ->
sink_srtn(c) srtn(c)  <=>
sink_6hoxmelatn(c) 6hoxmelatn(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_quln(c) quln(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_srtn(c) srtn(c)  ->
sink_Tyr-ggn(c) Tyr-ggn(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_glygn2(c) glygn2(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_34hpp(c) 34hpp(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_4hphac(c) 4hphac(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_adrnl(c) adrnl(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_dopa(c) dopa(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_fum(c) fum(c)  ->
sink_acac(c) acac(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_melanin(c) melanin(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_nrpphr(c) nrpphr(c)  ->
sink_uacgam(c) uacgam(c)  <=>
sink_udpglcur(c) udpglcur(c)  <=>
sink_ha(e) ha(e)  ->
sink_uacgam(c) uacgam(c)  <=>
Warning: Metabolite m8masn(r) not in model - added to the model
sink_m8masn(r) m8masn(r)  ->
sink_udpglcur(c) udpglcur(c)  <=>
sink_xu5p-D(c) xu5p-D(c)  ->
sink_ura(c) ura(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_val-L(c) val-L(c)  <=>
sink_3aib(c) 3aib(c)  ->
sink_val-L(c) val-L(c)  <=>
sink_succoa(m) succoa(m)  ->
sink_xoltriol(m) xoltriol(m)  <=>
sink_thcholstoic(m) thcholstoic(m)  ->
sink_xylu-D(c) xylu-D(c)  <=>
sink_glyclt(c) glyclt(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
FBA =
          full: [10600×1 double]
           obj: 999.1319
         rcost: [10600×1 double]
          dual: [5835×1 double]
        solver: 'tomlab_cplex'
     algorithm: 'default'
          stat: 1
       origStat: 1
          time: 0.2590
```

```
        basis: [16435×1 double]
            x: [10600×1 double]
            f: 999.1319
            y: [5835×1 double]
            w: [10600×1 double]
            v: [10600×1 double]
```

```
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_pyr(m) pyr(m)  ->
sink_pyr(c) pyr(c)  ->
sink_pyr(c) pyr(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_pyr(c) pyr(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_orn(c) orn(c)  ->
sink_pro-L(c) pro-L(c)  ->
sink_ptrc(c) ptrc(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_sprm(c) sprm(c)  ->
sink_spmd(c) spmd(c)  ->
sink_ptrc(c) ptrc(c)  ->
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
Warning: Metabolite pcreat[e] not in model - added to the model
```

```
EX_pcreat(e) pcreat[e]  ->
sink_creat(c) creat(c)  ->
sink_pcreat(c) pcreat(c)  ->
sink_lac-L(c) lac-L(c)  ->
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_glygn2(c) glygn2(c)  ->
sink_e4p(c) e4p(c)  ->
sink_mag-hs(c) mag-hs(c)  ->
sink_glyc(c) glyc(c)  ->
sink_accoa(m) accoa(m)  ->
sink_accoa(m) accoa(m)  ->
sink_accoa(m) accoa(m)  ->
sink_dhap(c) dhap(c)  ->
sink_amp(c) amp(c)  ->
sink_imp(c) imp(c)  ->
sink_prpp(c) prpp(c)  <=>
sink_gmp(c) gmp(c)  ->
sink_imp(c) imp(c)  ->
sink_thym(c) thym(c)  ->
sink_cmp(c) cmp(c)  ->
sink_dtmp(c) dtmp(c)  ->
sink_citr-L(c) citr-L(c)  <=>
sink_arg-L(c) arg-L(c)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_taur(c) taur(c)  ->
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_gly(c) gly(c)  <=>
sink_orn(c) orn(c)  ->
sink_citr-L(c) citr-L(c)  <=>
sink_urea(c) urea(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_gly(c) gly(c)  <=>
sink_gthrd(c) gthrd(c)  ->
sink_pro-L(c) pro-L(c)  <=>
sink_4abut(c) 4abut(c)  ->
sink_pro-L(c) pro-L(c)  <=>
sink_orn(c) orn(c)  ->
sink_met-L(c) met-L(c)  <=>
sink_hcys-L(c) hcys-L(c)  ->
sink_hcys-L(c) hcys-L(c)  <=>
sink_met-L(c) met-L(c)  ->
sink_hcys-L(c) hcys-L(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_lys-L(c) lys-L(c)  <=>
sink_glu-L(c) glu-L(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_trypta(c) trypta(c)  ->
sink_kynate(c) kynate(c)  <=>
sink_nicrnt(c) nicrnt(c)  ->
sink_pyr(c) pyr(c)  <=>
sink_lac-L(c) lac-L(c)  ->
sink_gal(c) gal(c)  <=>
sink_udpg(c) udpg(c)  ->
sink_fru(c) fru(c)  <=>
sink_lac-L(c) lac-L(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_malcoa(c) malcoa(c)  <=>
sink_eicostetcoa(c) eicostetcoa(c)  ->
sink_accoa(c) accoa(c)  <=>
sink_chsterol(r) chsterol(r)  ->
sink_inost(c) inost(c)  <=>
sink_glac(r) glac(r)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_pail4p_hs(c) pail4p_hs(c)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostgh2(c) prostgh2(c)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostgd2(r) prostgd2(r)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostge2(r) prostge2(r)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostgi2(r) prostgi2(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_25hvitd3(m) 25hvitd3(m)  <=>
sink_2425dhvitd3(m) 2425dhvitd3(m)  ->
sink_caro(c) caro(c)  <=>
sink_retinal(c) retinal(c)  ->
Warning: Model already has the same reaction you tried to add: sink_glu_L(c)
```

```
DM_pro-L(m) pro-L(m)  ->
sink_retinol-cis-11(c) retinol-cis-11(c)  <=>
sink_retinal(c) retinal(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_pchol-hs(c) pchol-hs(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_pe_hs(c) pe_hs(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_ps-hs(c) ps-hs(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_g3pc(c) g3pc(c)  ->
```

```
sink_dag_hs(c) dag_hs(c)  <=>
sink_pchol-hs(c) pchol-hs(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_pe_hs(c) pe_hs(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_clpn-hs(c) clpn-hs(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_pgp-hs(c) pgp-hs(c)  ->
sink_bhb(m) bhb(m)  <=>
sink_acac(m) acac(m)  ->
sink_mal-L(m) mal-L(m)  <=>
sink_pyr(m) pyr(m)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_gln-L(c) gln-L(c)  ->
sink_cys-L(c) cys-L(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_coa(c) coa(c)  ->
sink_occoa(m) occoa(m)  <=>
sink_accoa(m) accoa(m)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_lnlncgcoa(c) lnlncgcoa(c)  <=>
sink_dlnlcgcoa(c) dlnlcgcoa(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_chol(c) chol(c)  <=>
sink_ach(c) ach(c)  ->
sink_pyr(m) pyr(m)  <=>
sink_oaa(m) oaa(m)  ->
sink_crtn(c) crtn(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_arachd(c) arachd(c)  <=>
sink_leuktrE4(c) leuktrE4(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_arachd(c) arachd(c)  <=>
sink_C06314(c) C06314(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_nrpphr(c) nrpphr(c)  <=>
sink_3mox4hoxm(c) 3mox4hoxm(c)  ->
sink_sbt-D(c) sbt-D(c)  <=>
sink_fru(c) fru(c)  ->
sink_accoa(m) accoa(m)  ->
sink_succoa(m) succoa(m)  ->
```

```
cnt =  cnt + 1;
```

Test metabolic objective functions with closed sinks (lb). Note this step is time consuming and may only work reliably on Recon 3D derived models due to different usage of abbreviations.

```
TableChecks{cnt,1} = 'Test metabolic objective functions with closed sinks (lb)';
if 1 % perform test functions
    [TestSolution,TestSolutionNameClosedSinks, TestedRxnsClosedSinks, PercClosedSinks] = Test4
    TableChecks{cnt,2} = strcat('Done. See variable TestSolutionNameClosedSinks for results. T
else
    TableChecks{cnt,2} = 'Not performed.';
end
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_co2(c) co2(c)  ->
```

```
sink_nh4(c) nh4(c)  ->
sink_12ppd-S(c) 12ppd-S(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_12ppd-S(c) 12ppd-S(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_3pg(c) 3pg(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_gly(c) gly(c)  ->
sink_3pg(c) 3pg(c)  <=>
sink_ser-L(c) ser-L(c)  ->
sink_4abut(c) 4abut(c)  <=>
sink_succ(m) succ(m)  ->
sink_4hpro-LT(m) 4hpro-LT(m)  <=>
sink_glx(m) glx(m)  ->
sink_5aop(c) 5aop(c)  <=>
sink_pheme(c) pheme(c)  ->
sink_aact(c) aact(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_acac(m) acac(m)  <=>
sink_acetone(m) acetone(m)  ->
sink_acac(m) acac(m)  <=>
sink_bhb(m) bhb(m)  ->
sink_acald(c) acald(c)  <=>
sink_ac(c) ac(c)  ->
sink_accoa(c) accoa(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pmtcoa(c) pmtcoa(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_pmtcoa(c) pmtcoa(c)  <=>
sink_malcoa(m) malcoa(m)  ->
sink_acetone(c) acetone(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_acgal(c) acgal(c)  <=>
sink_udpacgal(c) udpacgal(c)  ->
sink_acgam(c) acgam(c)  <=>
sink_cmpacna(c) cmpacna(c)  ->
sink_acorn(c) acorn(c)  <=>
sink_orn(c) orn(c)  ->
sink_adrnl(c) adrnl(c)  <=>
sink_34dhoxpeg(c) 34dhoxpeg(c)  ->
sink_akg(m) akg(m)  <=>
sink_oaa(m) oaa(m)  ->
sink_akg(m) akg(m)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_akg(m) akg(m)  <=>
sink_ala-B(c) ala-B(c)  <=>
sink_msa(m) msa(m)  ->
sink_ala-D(c) ala-D(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_ala-L(c) ala-L(c)  <=>
sink_ala-D(c) ala-D(c)  ->
sink_ala-L(c) ala-L(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_arachd(c) arachd(c)  <=>
sink_malcoa(m) malcoa(m)  ->
sink_arachd(r) arachd(r)  <=>
sink_txa2(r) txa2(r)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_creat(c) creat(c)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_no(c) no(c)  ->
sink_arg-L(c) arg-L(c)  <=>
sink_pcreat(c) pcreat(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
```

```
Warning: Metabolite eryth(c) not in model - added to the model
sink_eryth(c) eryth(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
Warning: Metabolite lyxnt(c) not in model - added to the model
sink_lyxnt(c) lyxnt(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
sink_thrnt(c) thrnt(c)  ->
sink_ascb-L(c) ascb-L(c)  <=>
Warning: Metabolite xylnt(c) not in model - added to the model
sink_xylnt(c) xylnt(c)  ->
sink_asn-L(c) asn-L(c)  <=>
sink_oaa(c) oaa(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_hco3(c) hco3(c)  <=>
sink_arg-L(c) arg-L(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_asn-L(c) asn-L(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_argsuc(c) argsuc(c)  ->
sink_argsuc(c) argsuc(c)  <=>
sink_fum(c) fum(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_dcamp(c) dcamp(c)  ->
sink_dcamp(c) dcamp(c)  <=>
sink_fum(c) fum(c)  ->
sink_dcamp(c) dcamp(c)  <=>
sink_fum(c) fum(c)  ->
sink_asp-L(c) asp-L(c)  <=>
sink_oaa(c) oaa(c)  ->
sink_carn(c) carn(c)  <=>
sink_ala-B(c) ala-B(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_chol(c) chol(c)  <=>
sink_dag_hs(c) dag_hs(c)  <=>
sink_pe_hs(c) pe_hs(c)  ->
sink_chol(m) chol(m)  <=>
sink_glyb(m) glyb(m)  ->
sink_glyb(m) glyb(m)  <=>
sink_gly(m) gly(m)  ->
sink_coke(r) coke(r)  <=>
Warning: Metabolite pecgoncoa(r) not in model - added to the model
sink_pecgoncoa(r) pecgoncoa(r)  ->
sink_core2(g) core2(g)  <=>
sink_ksii_core2(g) ksii_core2(g)  ->
sink_core4(g) core4(g)  <=>
sink_ksii_core4(g) ksii_core4(g)  ->
sink_cspg_a(l) cspg_a(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_b(l) cspg_b(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_c(l) cspg_c(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_d(l) cspg_d(l)  <=>
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cspg_e(l) cspg_e(l)  <=>
```

```
sink_gal(l) gal(l)  ->
sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_glu-L(c) glu-L(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_gthrd(c) gthrd(c)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_3sala(c) 3sala(c)  ->
sink_3sala(c) 3sala(c)  <=>
sink_so4(c) so4(c)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_hyptaur(c) hyptaur(c)  ->
sink_Lcystin(c) Lcystin(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_dhap(c) dhap(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dmpp(c) dmpp(c)  <=>
Warning: Metabolite ggdp(c) not in model - added to the model
sink_ggdp(c) ggdp(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite dna(n) not in model - added to the model
sink_dna(n) dna(n)  <=>
Warning: Metabolite dna5mtc(n) not in model - added to the model
sink_dna5mtc(n) dna5mtc(n)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_L(c) dolichol_L(c)  <=>
Warning: Metabolite dolmanp_L(r) not in model - added to the model
sink_dolmanp_L(r) dolmanp_L(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_L(c) dolichol_L(c)  <=>
Warning: Metabolite g3m8mpdol_L(r) not in model - added to the model
sink_g3m8mpdol_L(r) g3m8mpdol_L(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_U(c) dolichol_U(c)  <=>
sink_dolmanp_U(r) dolmanp_U(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_dolichol_U(c) dolichol_U(c)  <=>
Warning: Metabolite g3m8mpdol_U(r) not in model - added to the model
sink_g3m8mpdol_U(r) g3m8mpdol_U(r)  ->
sink_dopa(c) dopa(c)  <=>
sink_homoval(c) homoval(c)  ->
sink_etoh(c) etoh(c)  <=>
sink_acald(c) acald(c)  ->
sink_f6p(c) f6p(c)  <=>
sink_g3p(c) g3p(c)  <=>
sink_r5p(c) r5p(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_frdp(c) frdp(c)  <=>
sink_dolichol_L(r) dolichol_L(r)  ->
Warning: Reaction EX_cbl1(e) not in model
```

```
Warning: Reaction EX_ca2(e) not in model
sink_frdp(c) frdp(c)  <=>
sink_dolichol_U(r) dolichol_U(r)  ->
sink_ade(c) ade(c)  <=>
sink_amp(c) amp(c)  ->
sink_adn(c) adn(c)  <=>
sink_urate(x) urate(x)  ->
sink_adp(c) adp(c)  <=>
sink_datp(n) datp(n)  ->
sink_cdp(c) cdp(c)  <=>
sink_dctp(n) dctp(n)  ->
sink_cmp(c) cmp(c)  <=>
sink_cytd(c) cytd(c)  ->
sink_cytd(c) cytd(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_dcmp(c) dcmp(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_gdp(c) gdp(c)  <=>
sink_dgtp(n) dgtp(n)  ->
sink_gln-L(c) gln-L(c)  <=>
sink_hco3(c) hco3(c)  <=>
sink_ump(c) ump(c)  ->
sink_gsn(c) gsn(c)  <=>
sink_urate(x) urate(x)  ->
sink_gua(c) gua(c)  <=>
sink_gmp(c) gmp(c)  ->
sink_hxan(c) hxan(c)  <=>
sink_imp(c) imp(c)  ->
sink_imp(c) imp(c)  <=>
sink_atp(c) atp(c)  ->
sink_imp(c) imp(c)  <=>
sink_gtp(c) gtp(c)  ->
sink_imp(c) imp(c)  <=>
sink_urate(x) urate(x)  ->
sink_prpp(c) prpp(c)  <=>
sink_imp(c) imp(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pydx(c) pydx(c)  <=>
sink_pydx5p(c) pydx5p(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thm(c) thm(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_thmpp(c) thmpp(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thm(e) thm(e)  <=>
sink_thmpp(m) thmpp(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thmmp(e) thmmp(e)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_thmpp(c) thmpp(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_thmpp(m) thmpp(m)  ->
sink_tyr-L(m) tyr-L(m)  <=>
sink_q10(m) q10(m)  ->
sink_udp(c) udp(c)  <=>
sink_dttp(n) dttp(n)  ->
sink_ump(c) ump(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_fru(c) fru(c)  <=>
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sink_dhap(c) dhap(c)  ->
sink_fru(c) fru(c)  <=>
sink_g3p(c) g3p(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_fuc-L(c) fuc-L(c)  <=>
sink_gdpfuc(c) gdpfuc(c)  ->
sink_fum(m) fum(m)  <=>
sink_oaa(m) oaa(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_g1p(c) g1p(c)  <=>
Warning: Metabolite dtdprmn(c) not in model - added to the model
sink_dtdprmn(c) dtdprmn(c)  ->
sink_g3p(c) g3p(c)  <=>
sink_mthgxl(c) mthgxl(c)  ->
sink_g6p(c) g6p(c)  <=>
sink_r5p(c) r5p(c)  ->
sink_g6p(c) g6p(c)  <=>
sink_ru5p-D(c) ru5p-D(c)  ->
sink_gal(c) gal(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_gal(c) gal(c)  <=>
sink_udpgal(c) udpgal(c)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_galgalgalthcrm_hs(g) galgalgalthcrm_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_acgagbside_hs(g) acgagbside_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_acnacngalgbside_hs(g) acnacngalgbside_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gd1b2_hs(g) gd1b2_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gd1c_hs(g) gd1c_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gp1c_hs(g) gp1c_hs(g)  ->
sink_galgluside_hs(g) galgluside_hs(g)  <=>
sink_gq1balpha_hs(g) gq1balpha_hs(g)  ->
sink_gam6p(c) gam6p(c)  <=>
sink_uacgam(c) uacgam(c)  ->
sink_gdpmann(c) gdpmann(c)  <=>
sink_gdpfuc(c) gdpfuc(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_inost(c) inost(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_lac-L(c) lac-L(c)  ->
sink_atp(c) atp(c)  ->
sink_h2o(c) h2o(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_lac-D(c) lac-D(c)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_lcts(g) lcts(g)  ->
sink_glc-D(c) glc-D(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_gln-L(c) gln-L(c)  <=>
sink_nh4(c) nh4(c)  ->
sink_gln-L(m) gln-L(m)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_gln-L(m) gln-L(m)  <=>
sink_glu-L(m) glu-L(m)  ->
sink_glu5sa(c) glu5sa(c)  <=>
sink_pro-L(c) pro-L(c)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_4abut(c) 4abut(c)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_gln-L(c) gln-L(c)  ->
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sink_glu-L(c) glu-L(c)  <=>
sink_pro-L(c) pro-L(c)  ->
sink_glu-L(m) glu-L(m)  <=>
sink_akg(m) akg(m)  ->
sink_gluside_hs(g) gluside_hs(g)  <=>
sink_galgluside_hs(g) galgluside_hs(g)  ->
sink_glx(m) glx(m)  <=>
sink_glyclt(m) glyclt(m)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_ser-L(c) ser-L(c)  ->
sink_ser-L(c) ser-L(c)  <=>
sink_pyr(c) pyr(c)  ->
sink_glyc(c) glyc(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_glyc(c) glyc(c)  <=>
sink_Rtotal(c) Rtotal(c)  <=>
sink_Rtotal2(c) Rtotal2(c)  <=>
sink_dag_hs(c) dag_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_glyc(c) glyc(c)  <=>
sink_Rtotal(c) Rtotal(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_tag_hs(c) tag_hs(c)  ->
sink_glyclt(c) glyclt(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_glygn2(c) glygn2(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_glygn2(e) glygn2(e)  <=>
sink_glc-D(e) glc-D(e)  ->
sink_glx(c) glx(c)  <=>
sink_oxa(c) oxa(c)  ->
sink_ha(l) ha(l)  <=>
sink_acgam(l) acgam(l)  ->
sink_glcur(l) glcur(l)  ->
sink_his-L(c) his-L(c)  <=>
sink_glu-L(c) glu-L(c)  ->
sink_his-L(c) his-L(c)  <=>
sink_hista(c) hista(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_hista(c) hista(c)  <=>
sink_3mlda(c) 3mlda(c)  ->
sink_hista(c) hista(c)  <=>
sink_im4act(c) im4act(c)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_chsterol(r) chsterol(r)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_frdp(x) frdp(x)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_xoldiolone(r) xoldiolone(r)  ->
sink_hmgcoa(x) hmgcoa(x)  <=>
sink_xoltriol(c) xoltriol(c)  ->
sink_hpyr(c) hpyr(c)  <=>
sink_2pg(c) 2pg(c)  ->
sink_hpyr(c) hpyr(c)  <=>
sink_glyclt(c) glyclt(c)  ->
sink_hpyr(c) hpyr(c)  <=>
sink_glyc-S(c) glyc-S(c)  ->
sink_hspg(l) hspg(l)  <=>
sink_gal(l) gal(l)  ->
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sink_glcur(l) glcur(l)  ->
sink_xyl-D(l) xyl-D(l)  ->
sink_hyptaur(c) hyptaur(c)  <=>
sink_taur(x) taur(x)  ->
sink_ile-L(c) ile-L(c)  <=>
sink_accoa(c) accoa(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model

sink_inost(c) inost(c)  <=>
sink_pail_hs(c) pail_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model

sink_inost(c) inost(c)  <=>
sink_pail45p_hs(c) pail45p_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model

sink_inost(c) inost(c)  <=>
sink_pail4p_hs(c) pail4p_hs(c)  ->
sink_inost(c) inost(c)  <=>
sink_xu5p-D(c) xu5p-D(c)  ->
sink_ipdp(x) ipdp(x)  <=>
sink_sql(r) sql(r)  ->
sink_itacon(m) itacon(m)  <=>
sink_pyr(m) pyr(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model

sink_ksi(l) ksi(l)  <=>
sink_man(l) man(l)  ->
sink_acgam(l) acgam(l)  ->
sink_ksii_core2(l) ksii_core2(l)  <=>
sink_Ser/Thr(l) Ser/Thr(l)  ->
sink_ksii_core4(l) ksii_core4(l)  <=>
sink_Ser/Thr(l) Ser/Thr(l)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite l2fn2m2masn(g) not in model - added to the model

sink_l2fn2m2masn(g) l2fn2m2masn(g)  <=>
Warning: Metabolite ksi(g) not in model - added to the model

sink_ksi(g) ksi(g)  ->
sink_lac-L(c) lac-L(c)  <=>
sink_glc-D(c) glc-D(c)  ->
sink_Lcyst(c) Lcyst(c)  <=>
sink_taur(x) taur(x)  ->
sink_leu-L(c) leu-L(c)  <=>
sink_accoa(c) accoa(c)  ->
sink_lys-L(c) lys-L(c)  <=>
sink_accoa(m) accoa(m)  ->
sink_lys-L(x) lys-L(x)  <=>
sink_aacoa(m) aacoa(m)  ->
Warning: Metabolite m8masn(r) not in model - added to the model

sink_m8masn(r) m8masn(r)  <=>
Warning: Metabolite nm4masn(g) not in model - added to the model

sink_nm4masn(g) nm4masn(g)  ->
sink_man(c) man(c)  <=>
sink_gdpmann(c) gdpmann(c)  ->
sink_man6p(c) man6p(c)  <=>
sink_kdn(c) kdn(c)  ->
sink_mescon(m) mescon(m)  <=>
sink_pyr(m) pyr(m)  ->
sink_met-L(c) met-L(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_mi145p(c) mi145p(c)  <=>
sink_inost(c) inost(c)  ->
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sink_msa(m) msa(m)  <=>
sink_ala-B(m) ala-B(m)  ->
sink_mthgxl(c) mthgxl(c)  <=>
sink_12ppd-S(c) 12ppd-S(c)  ->
sink_mthgxl(c) mthgxl(c)  <=>
sink_lac-D(c) lac-D(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_n2m2nmasn(l) n2m2nmasn(l)  <=>
sink_man(l) man(l)  ->
sink_acgam(l) acgam(l)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  <=>
Warning: Metabolite l2fn2m2masn(g) not in model - added to the model
sink_l2fn2m2masn(g) l2fn2m2masn(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  <=>
Warning: Metabolite n2m2nmasn(g) not in model - added to the model
sink_n2m2nmasn(g) n2m2nmasn(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Metabolite nm4masn(g) not in model - added to the model
sink_nm4masn(g) nm4masn(g)  <=>
Warning: Metabolite s2l2fn2m2masn(g) not in model - added to the model
sink_s2l2fn2m2masn(g) s2l2fn2m2masn(g)  ->
sink_o2s(c) o2s(c)  <=>
sink_h2o2(c) h2o2(c)  ->
sink_h2o2(c) h2o2(c)  <=>
sink_o2(c) o2(c)  <=>
sink_h2o(c) h2o(c)  ->
sink_orn(c) orn(c)  <=>
sink_nh4(c) nh4(c)  ->
sink_orn(c) orn(c)  <=>
sink_ptrc(c) ptrc(c)  ->
sink_orn(c) orn(c)  <=>
sink_spmd(c) spmd(c)  ->
sink_orn(c) orn(c)  <=>
sink_sprm(c) sprm(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_pail_hs(c) pail_hs(c)  <=>
sink_gpi_prot_hs(r) gpi_prot_hs(r)  ->
sink_pail45p_hs(c) pail45p_hs(c)  <=>
sink_mi145p(c) mi145p(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_pac(c) pac(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_pacald(c) pacald(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_peamn(c) peamn(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_phaccoa(c) phaccoa(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_pheacgln(c) pheacgln(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_phpyr(c) phpyr(c)  ->
sink_phe-L(c) phe-L(c)  <=>
sink_tyr-L(c) tyr-L(c)  ->
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sink_pheme(c) pheme(c)  <=>
sink_bilirub(c) bilirub(c)  ->
sink_phytcoa(x) phytcoa(x)  <=>
sink_dmnoncoa(m) dmnoncoa(m)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pmtcoa(c) pmtcoa(c)  <=>
sink_crmp_hs(c) crmp_hs(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_pmtcoa(c) pmtcoa(c)  <=>
sink_sphmyln_hs(c) sphmyln_hs(c)  ->
sink_ppcoa(m) ppcoa(m)  <=>
sink_succoa(m) succoa(m)  ->
sink_pro-L(c) pro-L(c)  <=>
sink_glu-L(c) glu-L(c)  ->
sink_ptrc(c) ptrc(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_ptrc(c) ptrc(c)  <=>
sink_spmd(c) spmd(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_pyr(c) pyr(c)  <=>
sink_fadh2(m) fadh2(m)  <=>
sink_fad(m) fad(m)  ->
sink_h(m) h(m)  ->
sink_pyr(c) pyr(c)  <=>
sink_lac-D(c) lac-D(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_pyr(c) pyr(c)  <=>
sink_nad(m) nad(m)  ->
sink_h(m) h(m)  ->
sink_pyr(c) pyr(c)  <=>
sink_accoa(m) accoa(m)  ->
sink_nadh(m) nadh(m)  ->
sink_co2(c) co2(c)  ->
sink_pyr(c) pyr(c)  <=>
sink_ala-L(c) ala-L(c)  ->
sink_ala-L(c) ala-L(c)  <=>
sink_pyr(c) pyr(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_s2l2fn2m2masn(l) s2l2fn2m2masn(l)  <=>
sink_man(l) man(l)  ->
sink_acgam(l) acgam(l)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_core2(g) core2(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_core4(g) core4(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
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sink_Tn_antigen(g) Tn_antigen(g)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_Ser/Thr(g) Ser/Thr(g)  <=>
sink_udpacgal(g) udpacgal(g)  <=>
sink_sTn_antigen(g) sTn_antigen(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cs_pre(g) cs_pre(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_a(g) cspg_a(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_c(g) cspg_c(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_d(g) cspg_d(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_e(g) cspg_e(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_hspg(g) hspg(g)  ->
sink_Ser-Gly/Ala-X-Gly(r) Ser-Gly/Ala-X-Gly(r)  <=>
sink_cspg_b(g) cspg_b(g)  ->
sink_ser-L(c) ser-L(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_so4(c) so4(c)  <=>
sink_paps(c) paps(c)  ->
sink_spmd(c) spmd(c)  <=>
sink_sprm(c) sprm(c)  ->
sink_srtn(c) srtn(c)  <=>
Warning: Metabolite f5hoxkyn(c) not in model - added to the model
sink_f5hoxkyn(c) f5hoxkyn(c)  ->
sink_srtn(c) srtn(c)  <=>
sink_fna5moxam(c) fna5moxam(c)  ->
sink_srtn(c) srtn(c)  <=>
Warning: Metabolite nmthsrtn(c) not in model - added to the model
sink_nmthsrtn(c) nmthsrtn(c)  ->
sink_succoa(m) succoa(m)  <=>
sink_oaa(m) oaa(m)  ->
sink_taur(x) taur(x)  <=>
sink_tchola(x) tchola(x)  ->
sink_thcholstoic(x) thcholstoic(x)  <=>
sink_gchola(x) gchola(x)  ->
sink_thcholstoic(x) thcholstoic(x)  <=>
sink_tchola(x) tchola(x)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_ppcoa(c) ppcoa(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_accoa(c) accoa(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_anth(c) anth(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_id3acald(c) id3acald(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_kynate(c) kynate(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_melatn(c) melatn(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_Lfmkynr(c) Lfmkynr(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_Lkynr(c) Lkynr(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_nformanth(c) nformanth(c)  ->
sink_srtn(c) srtn(c)  <=>
Warning: Metabolite 5moxact(c) not in model - added to the model
sink_5moxact(c) 5moxact(c)  ->
sink_srtn(c) srtn(c)  <=>
sink_6hoxmelatn(c) 6hoxmelatn(c)  ->
```

```
sink_trp-L(c) trp-L(c)  <=>
sink_quln(c) quln(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_srtn(c) srtn(c)  ->
sink_Tyr-ggn(c) Tyr-ggn(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
```

```
sink_glygn2(c) glygn2(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_34hpp(c) 34hpp(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_4hphac(c) 4hphac(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_adrnl(c) adrnl(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_dopa(c) dopa(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_fum(c) fum(c)  ->
sink_acac(c) acac(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_melanin(c) melanin(c)  ->
sink_tyr-L(c) tyr-L(c)  <=>
sink_nrpphr(c) nrpphr(c)  ->
sink_uacgam(c) uacgam(c)  <=>
sink_udpglcur(c) udpglcur(c)  <=>
sink_ha(e) ha(e)  ->
sink_uacgam(c) uacgam(c)  <=>
Warning: Metabolite m8masn(r) not in model - added to the model
```

```
sink_m8masn(r) m8masn(r)  ->
sink_udpglcur(c) udpglcur(c)  <=>
sink_xu5p-D(c) xu5p-D(c)  ->
sink_ura(c) ura(c)  <=>
sink_ala-B(c) ala-B(c)  ->
sink_val-L(c) val-L(c)  <=>
sink_3aib(c) 3aib(c)  ->
sink_val-L(c) val-L(c)  <=>
sink_succoa(m) succoa(m)  ->
sink_xoltriol(m) xoltriol(m)  <=>
sink_thcholstoic(m) thcholstoic(m)  ->
sink_xylu-D(c) xylu-D(c)  <=>
sink_glyclt(c) glyclt(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
FBA =
         full: [10600×1 double]
          obj: 999.1319
        rcost: [10600×1 double]
         dual: [5835×1 double]
       solver: 'tomlab_cplex'
    algorithm: 'default'
         stat: 1
     origStat: 1
         time: 0.2610
        basis: [16435×1 double]
            x: [10600×1 double]
            f: 999.1319
            y: [5835×1 double]
            w: [10600×1 double]
            v: [10600×1 double]

Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
```

```
sink_pyr(m) pyr(m)  ->
sink_pyr(c) pyr(c)  ->
sink_pyr(c) pyr(c)  ->
sink_ala-L(c) ala-L(c)  ->
```

```
sink_pyr(c) pyr(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_ala-L(c) ala-L(c)  ->
sink_orn(c) orn(c)  ->
sink_pro-L(c) pro-L(c)  ->
sink_ptrc(c) ptrc(c)  ->
sink_gln-L(c) gln-L(c)  ->
sink_sprm(c) sprm(c)  ->
sink_spmd(c) spmd(c)  ->
sink_ptrc(c) ptrc(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
Warning: Metabolite pcreat[e] not in model - added to the model
EX_pcreat(e) pcreat[e]  ->
sink_creat(c) creat(c)  ->
sink_pcreat(c) pcreat(c)  ->
sink_lac-L(c) lac-L(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_glygn2(c) glygn2(c)  ->
sink_e4p(c) e4p(c)  ->
sink_mag-hs(c) mag-hs(c)  ->
sink_glyc(c) glyc(c)  ->
sink_accoa(m) accoa(m)  ->
sink_accoa(m) accoa(m)  ->
sink_accoa(m) accoa(m)  ->
sink_dhap(c) dhap(c)  ->
sink_amp(c) amp(c)  ->
sink_imp(c) imp(c)  ->
sink_prpp(c) prpp(c)  <=>
sink_gmp(c) gmp(c)  ->
sink_imp(c) imp(c)  ->
sink_thym(c) thym(c)  ->
sink_cmp(c) cmp(c)  ->
sink_dtmp(c) dtmp(c)  ->
sink_citr-L(c) citr-L(c)  <=>
sink_arg-L(c) arg-L(c)  ->
sink_cys-L(c) cys-L(c)  <=>
sink_taur(c) taur(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_orn(c) orn(c)  ->
sink_citr-L(c) citr-L(c)  <=>
sink_urea(c) urea(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_gly(c) gly(c)  <=>
sink_gthrd(c) gthrd(c)  ->
sink_pro-L(c) pro-L(c)  <=>
sink_4abut(c) 4abut(c)  ->
sink_pro-L(c) pro-L(c)  <=>
sink_orn(c) orn(c)  ->
sink_met-L(c) met-L(c)  <=>
sink_hcys-L(c) hcys-L(c)  ->
```

```
sink_hcys-L(c) hcys-L(c)  <=>
sink_met-L(c) met-L(c)  ->
sink_hcys-L(c) hcys-L(c)  <=>
sink_cys-L(c) cys-L(c)  ->
sink_lys-L(c) lys-L(c)  <=>
sink_glu-L(c) glu-L(c)  ->
sink_trp-L(c) trp-L(c)  <=>
sink_trypta(c) trypta(c)  ->
sink_kynate(c) kynate(c)  <=>
sink_nicrnt(c) nicrnt(c)  ->
sink_pyr(c) pyr(c)  <=>
sink_lac-L(c) lac-L(c)  ->
sink_gal(c) gal(c)  <=>
sink_udpg(c) udpg(c)  ->
sink_fru(c) fru(c)  <=>
sink_lac-L(c) lac-L(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_malcoa(c) malcoa(c)  <=>
sink_eicostetcoa(c) eicostetcoa(c)  ->
sink_accoa(c) accoa(c)  <=>
sink_chsterol(r) chsterol(r)  ->
sink_inost(c) inost(c)  <=>
sink_glac(r) glac(r)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_pail4p_hs(c) pail4p_hs(c)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostgh2(c) prostgh2(c)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostgd2(r) prostgd2(r)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostge2(r) prostge2(r)  ->
sink_arachd(c) arachd(c)  <=>
sink_prostgi2(r) prostgi2(r)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_25hvitd3(m) 25hvitd3(m)  <=>
sink_2425dhvitd3(m) 2425dhvitd3(m)  ->
sink_caro(c) caro(c)  <=>
sink_retinal(c) retinal(c)  ->
Warning: Model already has the same reaction you tried to add: sink_glu_L(c)
DM_pro-L(m) pro-L(m)  ->
sink_retinol-cis-11(c) retinol-cis-11(c)  <=>
sink_retinal(c) retinal(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_pchol-hs(c) pchol-hs(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_pe_hs(c) pe_hs(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_ps-hs(c) ps-hs(c)  ->
sink_pail_hs(c) pail_hs(c)  <=>
sink_g3pc(c) g3pc(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_pchol-hs(c) pchol-hs(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_pe_hs(c) pe_hs(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_clpn-hs(c) clpn-hs(c)  ->
sink_dag_hs(c) dag_hs(c)  <=>
sink_pgp-hs(c) pgp-hs(c)  ->
sink_bhb(m) bhb(m)  <=>
sink_acac(m) acac(m)  ->
sink_mal-L(m) mal-L(m)  <=>
sink_pyr(m) pyr(m)  ->
sink_glu-L(c) glu-L(c)  <=>
sink_gln-L(c) gln-L(c)  ->
```

```
sink_cys-L(c) cys-L(c)  <=>
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_coa(c) coa(c)  ->
sink_occoa(m) occoa(m)  <=>
sink_accoa(m) accoa(m)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_lnlncgcoa(c) lnlncgcoa(c)  <=>
sink_dlnlcgcoa(c) dlnlcgcoa(c)  ->
Warning: Reaction with the same name already exists in the model, updating the reaction
sink_chol(c) chol(c)  <=>
sink_ach(c) ach(c)  ->
sink_pyr(m) pyr(m)  <=>
sink_oaa(m) oaa(m)  ->
sink_crtn(c) crtn(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_arachd(c) arachd(c)  <=>
sink_leuktrE4(c) leuktrE4(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_arachd(c) arachd(c)  <=>
sink_C06314(c) C06314(c)  ->
Warning: Reaction EX_cbl1(e) not in model
Warning: Reaction EX_ca2(e) not in model
sink_nrpphr(c) nrpphr(c)  <=>
sink_3mox4hoxm(c) 3mox4hoxm(c)  ->
sink_sbt-D(c) sbt-D(c)  <=>
sink_fru(c) fru(c)  ->
sink_accoa(m) accoa(m)  ->
sink_succoa(m) succoa(m)  ->
```

```
cnt =  cnt + 1;
```

Compute ATP yield. This test is identical to the material covered in the tutorial testModelATPYield.

```
TableChecks{cnt,1} = 'Compute ATP yield';
if 1 % test ATP yield
    [Table_csources, TestedRxns, Perc] = testATPYieldFromCsources(model);
    TableChecks{cnt,2} = 'Done. See variable Table_csources for results.';
else
    TableChecks{cnt,2} = 'Not performed.';
end
```

```
Warning: Reaction with the same name already exists in the model, updating the reaction
DM_atp_c_ h2o[c] + atp[c]  -> h[c] + adp[c] + pi[c]
```

```
cnt = cnt + 1;
```

Check for duplicated reactions in the model.

```
TableChecks{cnt,1} = 'Check duplicated reactions';
method='FR';
removeFlag=0;
[modelOut,removedRxnInd, keptRxnInd] = checkDuplicateRxn(model,method,removeFlag,0);
if isempty(removedRxnInd)
    TableChecks{cnt,2} = 'No duplicated reactions in model.';
else
    TableChecks{cnt,2} = 'Duplicated reactions in model.';
end
```

```
cnt = cnt + 1;
```

Check empty columns in 'model.rxnGeneMat'.

```
TableChecks{cnt,1} = 'Check empty columns in rxnGeneMat';
E = find(sum(model.rxnGeneMat)==0);
if isempty(E)
    TableChecks{cnt,2} = 'No empty columns in rxnGeneMat.';
else
    TableChecks{cnt,2} = 'Empty columns in rxnGeneMat.';
end
cnt = cnt + 1;
```

Check that demand reactions have a lb >= 0.

```
TableChecks{cnt,1} = 'Check that demand reactions have a lb >= 0';
DMlb = find(model.lb(strmatch('DM_',model.rxns))<0);
if isempty(DMlb)
    TableChecks{cnt,2} = 'No demand reaction can have flux in backward direction.';
else
    TableChecks{cnt,2} = 'Demand reaction can have flux in backward direction.';
end
cnt = cnt + 1;
```

Check consistency of model.rev with model.lb.

```
% model.rev not always included
if isfield(model,'rev')
TableChecks{cnt,1} = 'Check consistency of model.rev with model.lb';
Rev = setdiff(find(model.lb<0), find(model.rev==1));
if isempty(Rev)
    TableChecks{cnt,2} = 'model.rev and model.lb are consistent.';
else
    TableChecks{cnt,2} = 'model.rev and model.lb are NOT consistent.';
end
cnt = cnt + 1;
end
```

Check whether singleGeneDeletion runs smoothly.

```
TableChecks{cnt,1} = 'Check whether singleGeneDeletion runs smoothly';
try
    [grRatio,grRateKO,grRateWT,hasEffect,delRxns,fluxSolution] = singleGeneDeletion(model);
    TableChecks{cnt,2} = 'singleGeneDeletion finished without problems.';
catch
    TableChecks{cnt,2} = 'There are problems with singleGeneDeletion.';
end
```

```
Single gene deletion analysis in progress ...
```

```
cnt = cnt + 1;
```

Check for flux consistency.

```
TableChecks{cnt,1} = 'Check for flux consistency';
param.epsilon=1e-4;
```

```
param.modeFlag=0;
%param.method='null_fastcc';
param.method='fastcc';
printLevel = 1;
[fluxConsistentMetBool,fluxConsistentRxnBool,fluxInConsistentMetBool,fluxInConsistentRxnBool,m
```

```
fastcc.m: The input model is entirely flux consistent.\n
```

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fluxConsistentMetBool =
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```
model =
                            rxns: {10600×1 cell}
                            mets: {5835×1 cell}
```

```
                metFormulas: {5835×1 cell}
                         lb: [10600×1 double]
                         ub: [10600×1 double]
                 subSystems: {10600×1 cell}
                   rxnNames: {10600×1 cell}
                          S: [5835×10600 double]
                          b: [5835×1 double]
                          c: [10600×1 double]
                        rev: [10600×1 double]
                      genes: {2246×1 cell}
                    grRules: {10600×1 cell}
                  metCharge: [5835×1 double]
                 rxnGeneMat: [10600×2246 double]
                      rules: {10600×1 cell}
                     csense: [5835×1 char]
    fluxConsistentMetBool: [5835×1 logical]
    fluxConsistentRxnBool: [10600×1 logical]
fluxInConsistentMetBool: [5835×1 logical]
fluxInConsistentRxnBool: [10600×1 logical]
```

```
if isempty(find(fluxInConsistentRxnBool))
    TableChecks{cnt,2} = 'Model is flux consistent.';
else
    TableChecks{cnt,2} = 'Model is NOT flux consistent';
end
cnt = cnt + 1;
```

Display all results.

```
TableChecks
```

```
TableChecks =
    'fastLeakTest 1'                                                                    'Leak free!'
    'fastLeakTest 2 - add demand reactions for each metabolite in the model'            'Leak free when de
    'Exchanges, sinks, and demands have  lb = 0, except h2o'                            'model DOES NOT pr
    'Exchanges, sinks, and demands have  lb = 0, except h2o and o2'                     'model DOES NOT pr
    'Exchanges, sinks, and demands have  lb = 0, allow DM_atp_c_ to be reversible'      'model DOES NOT pr
    'Exchanges, sinks, and demands have  lb = 0, test flux through DM_h[m] (max)'       'model has NO flux
    'Exchanges, sinks, and demands have  lb = 0, test flux through DM_h[c] (max)'       'model has NO flux
    'ATP yield '                                                                        'model DOES NOT pr
    'Test metabolic objective functions with open sinks'                                'Done. See variabl
    'Test metabolic objective functions with closed sinks (lb)'                         'Done. See variabl
    'Compute ATP yield'                                                                 'Done. See variabl
    'Check duplicated reactions'                                                        'No duplicated rea
    'Check empty columns in rxnGeneMat'                                                 'No empty columns
    'Check that demand reactions have a lb >= 0'                                        'No demand reactio
    'Check consistency of model.rev with model.lb'                                      'model.rev and mod
    'Check whether singleGeneDeletion runs smoothly'                                    'There are problem
    'Check for flux consistency'                                                        'Model is flux con
```

Save all results.

```
resultsFileName = 'TestResults';
save(strcat(resultsFileName,'.mat'));
```

References

[1] Brunk, E. et al. Recon 3D: A resource enabling a three-dimensional view of gene variation in human metabolism. (submitted) 2017.