



## Product Information

### Nutrient Mixtures (Ham)

Ham's Nutrient Mixtures were originally developed to support clonal growth of several clones of Chinese hamster ovary (CHO) cells, as well as clones of HeLa and mouse L-cells. Both mixtures were formulated for use with or without serum supplementation, depending on the cell type being cultured. Ham's F-10 has been shown to support the growth of human diploid cells, white blood cells for chromosomal analysis, primary explants of rat, rabbit and chicken tissues. Ham's F-12 has been used for the growth of primary rat hepatocytes and rat prostate epithelial cells. A clonal toxicity assay using CHO cells has also been reported with Ham's F-12 as the medium of choice. Ham's F-12 is also available with 25mM HEPES buffer that provides more effective buffering in the optimum pH range of 7.2-7.4.

<b>COMPONENT</b>	<b>N 6635 (F-10)</b> g/L	<b>N 1387 (F-10)</b> g/L	<b>N 6760 (F-12)</b> g/L	<b>N 4388 (F-12)</b> g/L
<b>INORGANIC SALTS</b>				
CaCl <sub>2</sub> •2H <sub>2</sub> O	0.0441	0.0441	0.0441	0.0441
CuSO <sub>4</sub> •5H <sub>2</sub> O	0.000025	0.000025	0.000025	0.000025
FeSO <sub>4</sub> •7H <sub>2</sub> O	0.000834	0.000834	0.000834	0.000834
MgCl•6H <sub>2</sub> O	—	—	0.123	0.123
MgSO <sub>4</sub>	0.07464	0.07464	—	—
KCl	0.285	0.285	0.224	0.224
KH <sub>2</sub> PO <sub>4</sub>	0.083	0.083	—	—
NaCl	7.4	6.8	7.599	7.1
Na <sub>2</sub> HPO <sub>4</sub>	0.1537	0.1537	0.14204	0.14204
ZnSO <sub>4</sub> •7H <sub>2</sub> O	0.000288	0.000288	0.000863	0.000863
<b>AMINO ACIDS</b>				
L-Alanine	0.009	0.009	0.009	0.009
L-Arginine•HCl	0.211	0.211	0.211	0.211
L-Asparagine•H <sub>2</sub> O	0.01501	0.01501	0.01501	0.01501
L-Aspartic Acid	0.0133	0.0133	0.0133	0.0133
L-Cysteine•HCl•H <sub>2</sub> O	0.035	0.035	0.035	0.035
L-Glutamic Acid	0.0147	0.0147	0.0147	0.0147
L-Glutamine	0.146	0.146	0.146	0.146
Glycine	0.00751	0.00751	0.00751	0.00751
L-Histidine•HCl•H <sub>2</sub> O	0.021	0.021	0.02096	0.02096
L-Isoleucine	0.0026	0.0026	0.00394	0.00394
L-Leucine	0.0131	0.0131	0.0131	0.0131
L-Lysine•HCl	0.0293	0.0293	0.0365	0.0365
L-Methionine	0.00448	0.00448	0.00448	0.00448
L-Phenylalanine	0.00496	0.00496	0.00496	0.00496
L-Proline	0.0115	0.0115	0.0345	0.0345
L-Serine	0.0105	0.0105	0.0105	0.0105
L-Threonine	0.00357	0.00357	0.0119	0.0119
L-Tryptophan	0.0006	0.0006	0.00204	0.00204
L-Tyrosine 2Na•2H <sub>2</sub> O	0.00261	0.00261	0.00778	0.00778
L-Valine	0.0035	0.0035	0.0117	0.0117
<b>VITAMINS</b>				
D-Biotin	0.000024	0.000024	0.0000073	0.0000073
Choline Chloride	0.000698	0.000698	0.01396	0.01396
Folic Acid	0.00132	0.00132	0.00132	0.00132
myo-Inositol	0.000541	0.000541	0.018	0.018
Niacinamide	0.000615	0.000615	0.000037	0.000037
D-Pantothenic Acid •½Ca	0.000715	0.000715	0.00048	0.00048
Pyridoxine•HCl	0.000206	0.000206	0.000062	0.000062
Riboflavin	0.000376	0.000376	0.000038	0.000038
Thiamine•HCl	0.001	0.001	0.00034	0.00034
Vitamin B-12	0.00136	0.00136	0.00136	0.00136

Formulas continued next page

**Nutrient Mixtures (Ham) continued**

<b>COMPONENT</b>	<b>N 6635 (F-10)</b>	<b>N 1387 (F-10)</b>	<b>N 6760 (F-12)</b>	<b>N 4388 (F-12)</b>
	g/L	g/L	g/L	g/L
<b>OTHER</b>				
D-Glucose	1.1	1.1	1.802	1.802
HEPES	—	5.958	—	5.958
Hypoxanthine	0.00408	0.00408	0.00408	0.00408
Linoleic Acid	—	—	0.000084	0.000084
Phenol Red•Na	0.0013	0.0013	0.0013	0.0013
Putrescine•HCl	—	—	0.000161	0.000161
Pyruvic Acid•Na	0.11	0.11	0.11	0.11
Thioctic Acid	0.00021	0.00021	0.00021	0.00021
Thymidine	0.00073	0.00073	0.00073	0.00073
<b>ADD</b>				
Sodium Bicarbonate	1.2	1.2	1.176	1.176
Grams of powder required to prepare 1 L	9.8	15.2	10.7	16.2

*Formulas continued next page*

**Nutrient Mixtures (Ham)** continued

<b>COMPONENT</b>	<b>N 6013 (F-10) [1X] g/L</b>	<b>N 2147 (F-10) [1X] g/L</b>	<b>N 4888 (F-12) [1X] g/L</b>	<b>N 8641 (F-12) [1X] g/L</b>
<b>INORGANIC SALTS</b>				
CaCl <sub>2</sub> •2H <sub>2</sub> O	0.0441	0.0441	0.0441	0.0441
CuSO <sub>4</sub> •5H <sub>2</sub> O	0.0000025	0.0000025	0.0000025	0.0000025
FeSO <sub>4</sub> •7H <sub>2</sub> O	0.000834	0.000834	0.000834	0.000834
MgCl•6H <sub>2</sub> O	—	—	0.123	0.123
MgSO <sub>4</sub>	0.07464	0.07464	—	—
KCl	0.285	0.285	0.224	0.224
KH <sub>2</sub> PO <sub>4</sub>	0.083	0.083	—	—
NaHCO <sub>3</sub>	1.2	—	1.176	1.176
NaCl	7.4	7.4	7.599	7.1
Na <sub>2</sub> HPO <sub>4</sub>	0.1537	0.1537	0.14204	0.14204
ZnSO <sub>4</sub> •7H <sub>2</sub> O	0.0000288	0.0000288	0.000863	0.000863
<b>AMINO ACIDS</b>				
L-Alanine	0.009	0.009	0.009	0.009
L-Arginine•HCl	0.211	0.211	0.211	0.211
L-Asparagine•H <sub>2</sub> O	0.01501	0.01501	0.01501	0.01501
L-Aspartic Acid	0.0133	0.0133	0.0133	0.0133
L-Cysteine•HCl•H <sub>2</sub> O	0.035	0.035	0.035	0.035
L-Glutamic Acid	0.0147	0.0147	0.0147	0.0147
Glycine	0.00751	0.00751	0.00751	0.00751
L-Histidine•3HCl•H <sub>2</sub> O	0.021	0.021	0.02096	0.02096
L-Isoleucine	0.0026	0.0026	0.00394	0.00394
L-Leucine	0.0131	0.0131	0.0131	0.0131
L-Lysine•HCl	0.0293	0.093	0.0365	0.0365
L-Methionine	0.00448	0.00448	0.00448	0.00448
L-Phenylalanine	0.00496	0.00496	0.00496	0.00496
L-Proline	0.0115	0.0115	0.0345	0.0345
L-Serine	0.0105	0.0105	0.0105	0.0105
L-Threonine	0.00357	0.00357	0.0119	0.0119
L-Tryptophan	0.0006	0.0006	0.00204	0.00204
L-Tyrosine 2Na•2H <sub>2</sub> O	0.00261	0.00261	0.00778	0.00778
L-Valine	0.0035	0.0035	0.0117	0.0117
<b>VITAMINS</b>				
D-Biotin	0.000024	0.000024	0.0000073	0.0000073
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Folic Acid	0.00132	0.00132	0.00132	0.00132
myo-Inositol	0.000541	0.000541	0.018	0.018
Niacinamide	0.000615	0.000615	0.000037	0.000037
D-Pantothenic Acid •½Ca	0.000715	0.000715	0.00048	0.000238
Pyridoxine•HCl	0.000206	0.000206	0.000062	0.000062
Riboflavin	0.000376	0.000376	0.000038	0.000038
Thiamine•HCl	0.001	0.001	0.00034	0.00034
Vitamin B-12	0.00136	0.00136	0.00136	0.00136
<b>OTHER</b>				
D-Glucose	1.1	1.1	1.802	1.802
HEPES	—	4.77	—	5.958
Hypoxanthine	0.00408	0.00408	0.00408	0.00408
Linoleic Acid	—	—	0.000084	0.000084
Phenol Red (sodium)	0.0013	0.0013	0.0013	0.0013
Putrescine•HCl	—	—	0.000161	0.000161
Pyruvic Acid (sodium)	0.11	0.11	0.11	0.11
Thioctic Acid	0.00021	0.00021	0.00021	0.00021
Thymidine	0.00073	0.00073	0.00073	0.00073

*Formulas continued next page*

**Nutrient Mixtures (Ham) continued**

<b>COMPONENT</b>	<b>N 6013</b>	<b>N 2147</b>	<b>N 4888</b>	<b>N 8641</b>
<b>ADD</b>	<b>(F-10)</b>	<b>(F-10)</b>	<b>(F-12)</b>	<b>(F-12)</b>
	<b>[1X]</b>	<b>[1X]</b>	<b>[1X]</b>	<b>[1X]</b>
	<b>g/L</b>	<b>g/L</b>	<b>g/L</b>	<b>g/L</b>
L-Glutamine	0.146	0.146	0.146	0.146
Sodium Bicarbonate	—	—	—	—

**REFERENCES**

1. Ham, R.G., (1963). An Improved Nutrient Solution for Diploid Chinese Hamster and Human Cell Lines. *Exp. Cell Res.* 29, 515-526.
2. Ham, R.G., (1965). Clonal Growth of Mammalian Cells in a Chemically Defined, Synthetic Medium. *Proc. Nat. Acad. Sci.* 53, 288-293.