

## Making 1 Molar (M) and 1 Normal (N) solutions from SEASTAR™'s Products:

Note: to maintain the trace metal purity of SEASTAR™'s products these solutions must be made in a trace metal clean room (at least Class 100) and the water used must be of the same trace metal quality or better (for example, de-ionized, 18 megaohm water or SEASTAR™'s **BASELINE®** Water).

SEASTAR™'s Products	Density (g/mL)	Molarity (M, mol/L)*	Normality (N, mol/L)*	Volume (ml) required to make 1 litre of solution*		Mass (g) required to make 1 litre of solution*	
				1M	1N	1M	1N
Nitric Acid (67 – 70%)	1.41	16	16	64	64	90	90
Perchloric Acid (75 – 71%)	1.67	12	12	86	86	144	144
Sulphuric Acid (93 – 98%)	1.84	18	36	56	28	102	51
Hydrochloric Acid (32 – 37%)	1.17	11	11	92	92	107	107
Hydrofluoric Acid (47 – 51%)	1.18	29	29	34	34	41	41
Acetic Acid (>99%)	1.05	18	18	57	57	86	86
Ammonia Solution (20 – 22%)	0.92	11	11	88	88	81	81
Hydrobromic Acid (44 – 49%)	1.5	9	9	111	111	167	167
Hydrogen Peroxide (30 – 32%)	1.13	10	10	102	102	116	116

\*Please note: if you require an accurate molarity or normality, for the product you have purchased, you will have to do the measurement. Bottles within a given lot have small assay variations. The actual lot analysis may also vary from the table above.

Normality is a concept related to molarity, usually applied to acid-base solutions and reactions. For acid-base reactions, the equivalent is the mass of acid or base that can accept or donate exactly one mole of protons (H<sup>+</sup> ions). For Nitric Acid, HNO<sub>3</sub> this ratio is 1:1, one H<sup>+</sup> ion per mole of HNO<sub>3</sub>. For Sulphuric Acid, H<sub>2</sub>SO<sub>4</sub> this ratio is 2:1, two H<sup>+</sup> ions per mole of H<sub>2</sub>SO<sub>4</sub>. Hence the normality of H<sub>2</sub>SO<sub>4</sub> is twice the molarity.

**SAFETY NOTES:** The hydration reaction of many acids, with water, are highly exothermic. If water is added to a concentrated acid, it can boil and spit dangerously. One should always add **SLOWLY the ACID TO THE WATER** rather than the water to the acid. Be aware that large amounts of heat may be generated during this process.

Consult your MSDS, prior to handling these materials, for proper safety apparel. Gloves, safety glasses, face shield and apron. This work should be done in a properly functioning fume hood. Check you MSDS section on Exposure control and Personal Protection (Engineering Controls).

## Sample calculation: to make a 1 Molar Solution of Nitric Acid, from SEASTAR™'s Nitric Acid (67 - 70% w/w)

Concentrated Reagent	Density (g/mL)	Molarity (M, mol/L)*	Normality (N, mol/L)*	Volume (ml) required to make 1 litre of solution*		Mass (g) required to make 1 litre of solution*	
				1M	1N	1M	1N
Nitric Acid (67 – 70%)	1.41	16	16	64	64	90	90

Conversion factors: 1000mL = 1L

### Calculation: SEASTAR™'s Nitric Acid has a molarity of approximately 15.6 moles/L

1L contains 15.6 moles, therefore 1 mole is contained within = 1L / 15.6 moles.

1 mole = 0.064 Litres  
= 64 mL

Mass of 64 mL of SEASTAR™'s Nitric Acid, 67 - 70% w/w  
 64 mL  
 1.41g/mL (approximate density of SEASTAR™'s Nitric Acid)  
 90g (64mL x 1.41 g/mL) of SEASTAR™'s Nitric Acid

Add 64mL, or 90g, of SEASTAR™'s Nitric Acid, to water up to 1L

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