Minerals – Weights and Measures

All minerals (and most supplements) should be added by weight. Using "kitchen" measures or scoops is unreliable and, with some trace minerals, the difference of a gram weight can double the amount of mineral.
Accurate weighing of minerals requires a gram scale that weighs to 0.1 grams. These can be found reasonably priced as "pocket scales" from several sources online:
http://www.scalesgalore.com/
http://pocket.balances.com/

With a scale, you can standardize your measures and scoops. You can reweigh them periodically (preferably with each new batch of minerals) as several things can affect the weight per measure – settling, moisture content, difference in particle size, etc.

Math of Measuring

The math can be confusing at first but it is not difficult.

Major Minerals are usually shown as percent (%), which is grams of elemental mineral per gram of compound.
The most confusing part is that the term "gram" is used both as the amount (by weight) of elemental mineral in a compound and as the total weight of the compound.
I will use the abbreviation "g" for the elemental mineral and "gram" or "grams" for the total compound.

An example is Magnesium Oxide 56%
There are 0.56g of magnesium (elemental mineral) per 1 gram (weight) of magnesium oxide (compound).
The formula for this is

percent ÷ 100 = g of elemental mineral per gram of compound or
56 ÷ 100 = 0.56g magnesium per gram of magnesium oxide

So, if you want to add 10 g magnesium using a 56% magnesium oxide:

10 ÷ 0.56 = 17.8 grams (weight) of magnesium oxide

Another example:
For Calcium Carbonate 38%, if you need to add 20g calcium:

38 ÷ 100 = 0.38g calcium per gram of calcium carbonate
20 ÷ 0.38 = 52.6 grams (weight) of calcium carbonate

Not all compounds contain the exact same percent of elemental mineral – some magnesium oxide is 54%, some is 58%; magnesium proteinate can be 10% or more depending on manufacturer, so you need to check the product label.

Trace Minerals purchased in bulk are often labeled as percent (%), which is g of elemental mineral per gram of compound.

When a trace mineral is shown in "percent", the math is similar to the major mineral math. But, because we feed trace minerals in smaller amounts (mg rather than g) we have to convert the g to mg. Each g is equal to 1000 mg.

Example:
Copper Sulfate 25%

25 ÷ 100 = 0.25g copper per gram of copper sulfate

Because each g is equal to 1000 mg

0.25 x 1000 = 250mg copper per gram of copper sulfate

So, if you need to add 150mg copper using a 25% copper sulfate:

150 ÷ 250 = 0.6 grams (weight) of copper sulfate

This is a pretty tiny amount – you can see why you need that gram scale!

Another example:
For Poly-Copper 12.5%, if you need to add 150mg copper

12.5 ÷ 100 = 0.125g copper per gram of poly-copper

0.125 x 1000 = 125mg copper per gram of poly-copper

150 ÷ 125 = 1.2 grams (weight) of poly-copper

Trace Minerals as "ppm"

The term "ppm" (parts per million) is usually the term used in showing how much of a trace mineral is contained in a supplement. PPM is mg (milligram) of mineral per kg (kilogram) of product.
You can use this to figure out how many mg of a mineral are contained in a supplement you use. Because supplement feeding instructions are usually "per ounce" (or per 1 ounce scoop), we will figure mg per ounce. You may have to adjust this for your supplement.

[1 kg = 2.2 lbs, 1lb = 16oz]

Example:

Farrier's Formula contains copper at 540ppm

ppm = mg per kg
540ppm = 540mg copper per 1kg of Farrier's Formula
540 ÷ 2.2 = 245.5mg copper per 1lb of Farrier's Formula
245.5 ÷ 16 = 15.3mg copper per 1oz of Farrier's Formula
(or ~90mg in the recommended 6oz serving)

Farrier's Formula also contains iodine at 4.7ppm

4.7 ÷ 2.2 ÷ 16 = 0.13mg iodine per 1oz of Farrier's Formula
(or 0.8mg in the recommended 6oz serving)

Other "stuff" in my supplement

You can also do "reverse" math to figure how much of what is contained in a supplement if it is shown in "percent".
[1oz = 28.4grams]

Farrier's Formula contains 0.636% Lysine

0.636 ÷ 100 = 0.0063g Lysine in 1 gram (weight) of Farrier's Formula
0.0063 x 28.4 = 0.18g Lysine in 1oz Farrier's Formula
(or 1.08gm in the recommended 6oz serving)
You can multiply by 1000 to see how many mg this is
0.18g x 1000 = 180mg

Commonly Discussed Minerals

Major Minerals (these also function as electrolytes)		
Calcium	Ca	Calcium carbonate 38% 0.38 grams/gram
Phosphate	P	Monosodium phosphate P 26%, Na 19.3% P=0.26 grams/gram
Magnesium	Mg	Magnesium oxide 54%, 56%, 58% 56% = 0.56 grams/gram Magnesium proteinate 10% Magnesium carbonate 40%
Potassium	K	Potassium chloride K-54% Cl-45%
Sodium and Chloride	Na Cl	NaCl = Sodium chloride ("salt") Na 39.3%, Cl 60.6% Table salt provides 11.2gm Na per ounce
Trace Minerals		
Iron	Fe	Iron (ferrous) sulfate, Adequate to excessive in forages and feeds
Copper	Cu	Copper sulfate 28% 280 mg/gram Poly copper 12.7% (HorseTech) 127 mg/gram Poly copper 12.5% (Uckele) 125 mg/gram Copper proteinate varies (5-15%)
Zinc	Zn	Zinc sulfate 35.5% 355 mg/gram Poly zinc 22% (HorseTech & Uckele) 220 mg/gram Zinc proteinate varies (4-18%)
Manganese	Mn	Manganese sulfate 35% 350 mg/gram Poly manganese 16% (HorseTech) 160 mg/gram Poly manganese 20% (Uckele) 200 mg/gram Manganese proteinate varies (8-16%)
Cobalt	Co	Cobalt glucoheptonate 2.5% Usually adequate in forage, may be included in premixes
Iodine	I	Potassium iodide (table salt provides approx 1.7mg per oz, degrades with age), Kelp (not standardized, see Source file)
Selenium	Se	Selenium yeast – 2 mg/gram (2,000 ppm) Various supplements, often combined with vit E
Chromium	Cr	Chromium yeast – (2 mg/gram) 2,000 ppm G.T.F. Chromium - (3 mg/gram) (Uckele brand) "Human" tablets, usually 200 or 400mcg
Molybdenum	Mo	Considered contaminant from industrial pollution
Aluminum	Al	Considered contaminant from acid rain

*Percentages can vary depending on manufacturer/source and processing
Online periodic table: http://www.webelements.com/

Some Handy Terms

Gram – g
Milligram – mg
Microgram – mcg or μ
Kilogram – kg
Parts per million - ppm

1 g = 1000mg (multiply g by 1000 to get mg or divide mg by 1000 to get g)
1mg = 1000mcg (divide mcg by 1000 to get mg, multiply mg by 1000 to get mcg – useful for calculating how many chromium tabs you need)
1kg = 2.2 lbs
1kg = 1,000 grams
1lb = 16oz
1lb = 453.6g
1oz = 28.4g

Percent – g of element in grams of compound
For the metrically challenged, think of
"If I had 2oz of baking powder mixed with 8oz flour to make 10 oz baking powder flour (cake flour)",

- the *element* is baking powder
- the *compound* is "baking powder flour",
- the total weight is 10oz, the percent of baking powder is 20%.

It would be called "Baking powder flour 20%".
It would provide 0.2g baking powder per gram of baking powder flour.

Parts per million – mg per kg
(How many mg of something is contained in one kg of the mix. Divide by 2.2 for mg per lb; divide again by 16 for mg per oz.)
Divide ppm by 1000 for mg per gram.

Online conversion calculator:

http://www.onlineconversion.com/weight_metric.htm

If my mineral is only 56% - or 12%, etc., what's in the rest of it?

A mineral is a naturally occurring, inorganic solid with a definite chemical composition and a specific crystalline structure. A rock is an aggregate of one or more minerals and may contain organic remains.

Minerals naturally occur or are processed as part of a compound. Some minerals occur in fairly "pure" forms – such as some precious metals – but most occur in compounds. Some compounds can be used as is with little processing; some are separated out of the compound (using solvents, distillation, heat or other processes) and mixed with other things to become a more usable form.

Some of the "inorganic" compounds we see are:

Carbonate
Sulphate
Oxide
Phosphate

With calcium carbonate as an example, 38% is calcium; the other 62% is carbonate, a weak base. As the calcium is separated out by digestions, most of the carbonate will simply pass through and be excreted from the GI tract; some may be absorbed and utilized by the body.

Chelated minerals are mineral salt ions bonded to an organic molecule to form a chelate complex. The common ones we use are "poly" (bonded to a polysaccharide molecule), "proteinate" and "amino acid" (bonded to a protein or specific amino acid).

Some "inorganic" minerals are absorbed directly from the GI tract; others which require bonding to a protein for transport across the GI mucosa are "naturally chelated" by the digestive system. Research has never shown that feeding chelated minerals improves absorption (and it may decrease absorption in some circumstances).

You can Wiki calcium carbonate and other minerals to learn more than you ever wanted to know - http://en.wikipedia.org/wiki/Calcium_carbonate.

(This is only meant as an extremely brief introduction)