

MASS-VOLUME EQUIVALENTS OF COMMON CHEMICAL SOLIDS

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Volume and temperature measurements can easily be used for many materials, but when using weight measurements of solid materials there are no universal measurements. The masses of solids vary widely and a balance is needed for accurate measurements. Since accurate balances can be expensive, a cheaper alternative is knowing the approximate weight equivalents of various substances using common kitchen measuring devices. The following table lists the approximate weights of some common materials.

Measuring devices vary greatly from manufacturer to manufacturer. A cup measure can vary as much as 10% between two manufacturers. There are also differences in capacities between glass, plastic, and metal measuring devices. In addition, relationships between measuring devices within a set show variations from standards. For example, in a set of measuring spoons used by the author, one tablespoon was slightly more than 3 teaspoons.

Finding accurate measuring devices is not practical. Instead, when purchasing measuring devices for class use, purchase several sets from a single manufacturer to reduce variations in the class. Test all procedures and make adjustments in recipes, as needed, to allow for variations in the measuring devices.

All volume measurements were made by overfilling the measuring device and leveling with a spatula. No effort was made to pack material into the measuring device.

All weights were measured in grams. Ounces can be calculated using an equivalent of 453.6 grams per pound.

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
aluminum potassium sulfate	$KAl(SO_4)_2 \cdot 12H_2O$	powder	3.6	10.8	173	
aluminum sulfate	$Al_2(SO_4)_3$	powder	3.8	11.4	182	
ammonium carbonate	$(NH_4)_2CO_3$	powder	3.0	9.0	144	
ammonium nitrate	NH_4NO_3	crystal	3.8	11.2	180	
ascorbic acid	$C_6H_8O_6$	crystal	2.8	8.4	134	
boric acid	H_3BO_3	powder	4.0	12	192	
calcium acetate	$Ca(C_2H_3O_2)_2$	crystal	1.9	5.7	91.2	
calcium carbonate	$CaCO_3$	powder chips	1.5 6.3	4.5 19	72 302	
calcium chloride	$CaCl_2$	round mesh	4.5	13.5	216	
calcium hydroxide	$Ca(OH)_2$	powder	2.2	6	96	
calcium oxide	CaO	powder	1.5	4.5	72	
calcium phosphate	$Ca(H_2PO_4)_2$	crystal	3.9	9.0	144	
calcium sulfate	$CaSO_4 \cdot 2H_2O$	powder	1.4	4.2	67	
carbon (activated)	C	granular	2.1	6.3	131	
citric acid	$C_6H_8O_7 \cdot H_2O$	crystal	3.6	10.8	-	
cobalt chloride	$CoCl_2 \cdot 6H_2O$	powder	4.5	13.2	211	
copper(II) chloride	$CuCl_2 \cdot 2H_2O$	crystal	4.7	14.1	226	
copper(II) sulfate	$CuSO_4 \cdot 5H_2O$	large crystals	6.4	19.2	307	
flour (all purpose)		powder	2.5	7	118	
glucose	$C_6H_{12}O_6$	crystals	3.5	10.5	168	
iron(III) chloride	$FeCl_3 \cdot 6H_2O$	powder	5.1	15.3	245	
iron(III) nitrate	$Fe(NO_3)_3 \cdot 9H_2O$	crystals	4.6	13.7	219	
lithium chloride	$LiCl$	fine crystal	4.0	12.67		
luminol		powder		6.4		1/8 tsp = 0.8 g
magnesium chloride	$MgCl_2 \cdot 6H_2O$	wet crystals	3.2	9.7	155	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
magnesium hydroxide	Mg(OH) ₂	fine granular	2.4	7.2	115	
magnesium sulfate	MgSO ₄ •7H ₂ O	fine crystals	3.3	9.9	158	
magnesium sulfate (anhy.)	MgSO ₄	crystals	3.6	10.8	173	
manganese dioxide	MnO ₂	powder	9.25	27.8	-	1/8 tsp = 1.35 g
methylene blue	C ₁₆ H ₁₈ ClN ₃ S	powder	3.3	9.9	-	1/8 tsp = 0.4 g
naphthalene	C ₁₀ H ₈	crystal	2.6	7.8	125	
oxalic acid	HO ₂ CCO ₂ H	crystal	3.5	10.5	168	
paradichlorobenzene	C ₆ H ₄ Cl ₂	crystal	3.4	10.1	163	
phenolphthalein	C ₂₀ H ₁₄ O ₄	powder	1.84	-	-	1/8 tsp = 0.23 g
potassium aluminum sulfate	KAl(SO ₄) ₂ •12H ₂ O	powder	3.6	10.8	173	
potassium bitartrate	KHC ₄ H ₄ O ₆	powder	2.7	8	130	
potassium bromide	KBr	granular	6.2	18.6	298	
potassium chloride	KCl	crystal	4.5	13.5	216	
potassium chrome alum	KCr(SO ₄) ₂ •12H ₂ O	crystal	3.9	11.6	186	
potassium dichromate	K ₂ Cr ₂ O ₇	crystal	5.4	16.3	260	
potassium ferricyanide	K ₃ Fe(CN) ₆	fine crystal	4.0	12	192	
potassium ferrocyanide	K ₄ Fe(CN) ₆ •3H ₂ O	lump, flakes	4.6	13.6	218	
potassium hydroxide	KOH	pellets	4.5	13.5	216	
potassium iodate	KIO ₃	powder	3.3	9.8	157	
potassium nitrate	KNO ₃	crystal	5.7	17	274	
potassium oxalate	K ₂ C ₂ O ₄	crystal	4.2	12.6	202	
potassium permanganate	KMnO ₄	fine crystal	5.7	17.1	274	1/8 tsp = 0.95 g
potassium sodium tartrate	KNaC ₄ H ₄ O ₆ •4H ₂ O	crystal	4.0	12	192	
potassium thiocyanate	KSCN	crystal	3.5	10.5	168	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
sodium acetate (anhy.)	NaC ₂ H ₃ O ₂	crystal	2.6	7.8	125	
sodium acetate	NaC ₂ H ₃ O ₂ •3H ₂ O	crystal	3.8	11.4	182	
sodium bicarbonate sodium hydrogen carbonate	NaHCO ₃	powder	4.7	14.5	240	
sodium bisulfite	NaHSO ₃	crystal	5.5	16.5	264	
sodium borate	Na ₂ B ₄ O ₇	crystal	3.3	9.9	158	
sodium carbonate	Na ₂ CO ₃ •H ₂ O	powder	4.6	13.8	221	
sodium carbonate (anhy.)	Na ₂ CO ₃	powder	4.7	14	225	
sodium chloride	NaCl	crystal	6.0	18	290	
sodium hydroxide	NaOH	pellets	4.6	13.8	221	
sodium nitrate	NaNO ₃	crystal	4.6	13.8	221	
sodium phosphate	Na ₃ PO ₄ •12H ₂ O	crystal	3.6	10.8	173	
sodium silicate	Na ₂ SiO ₃	powder	4.0	12	192	
sodium sulfate	Na ₂ SO ₄	powder	6	18	288	
sodium sulfite	Na ₂ SO ₃	crystal	5.5	16.5	264	
sodium thiosulfate	Na ₂ S ₂ O ₃	crystal	3.75	11.2	180	
starch		powder	2.4	7.3	117	
strontium chloride	SrCl ₂ •6H ₂ O	crystal	4.2	12.7	203	
sucrose	C ₁₂ H ₂₂ O ₁₁	granular	4.0	12	192	
sulfur	S	powder	3.2	9.6	154	
tannic acid	C ₇₆ H ₅₂ O ₄₆	powder	1.27	3.81	61	
thymolphthalein	C ₂₈ H ₃₀ O ₄	powder	2.3	7	-	1/8 tsp = 0.2 g
urea	H ₂ NCONH ₂	round pellets	3.4	10.2	163	
zinc	Zn	granular (20 mesh)	10	30	480	