Calculation of equivalent weight pdf

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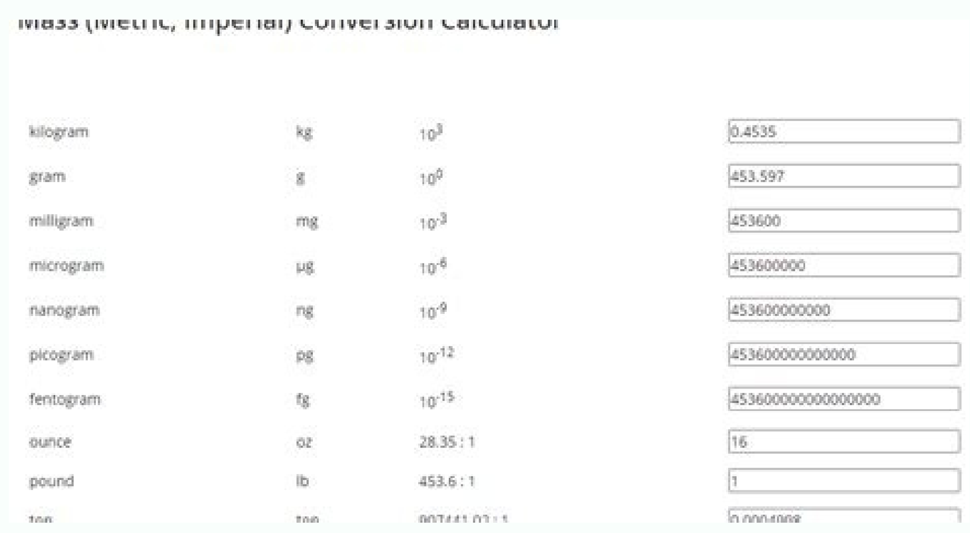
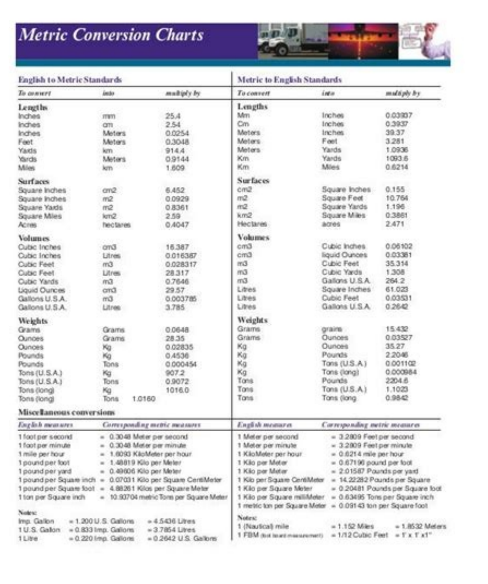
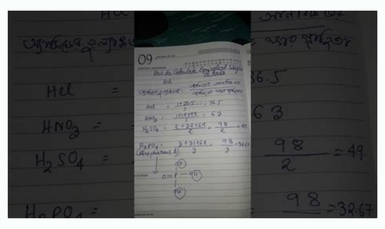
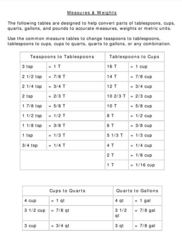
Pounds	Kilograms	Pounds	Kilograms	Pounds	Kilograms	Pounds	Kilograms	Pounds	Kilograms
5	2.3	58	26.3	111	50.3	164	74.4	217	98.4
6	2.7	59	26.8	112	50.8	165	74.8	218	98.9
7	3.2	60	27.2	113	51.3	166	75.3	219	99.3
8	3.6	61	27.7	114	51.7	167	75.8	220	99.8
9	4.1	62	28.1	115	52.2	168	76.2	221	100.2
10	4.5	63	28.6	116	52.6	169	76.7	222	100.7
11	5.0	64	29.0	117	53.1	170	77.1	223	101.2
12	5.4	65	29.5	118	53.5	171	77.6	224	101.6
13	5.9	66	29.9	119	54.0	172	78.0	225	102.1
14	6.4	67	30.4	120	54.4	173	78.5	226	102.5
15	6.8	68	30.8	121	54.9	174	78.9	227	103.0
16	7.3	69	31.4	122	55.3	175	79.4	228	103.4
17	7.7	70	31.8	123	55.8	176	79.8	229	103.9
18	8.2	71	32.2	124	56.2	177	80.3	230	104.3
19	8.6	72	32.7	125	56.7	178	80.7	231	104.8
20	9.1	73	33.1	126	57.2	179	81.2	232	105.2
21	9.5	74	33.6	127	57.6	180	81.6	233	105.7
22	10.0	75	34.0	128	58.1	181	82.1	234	106.1
23	10.4	76	34.5	129	58.5	182	82.6	235	106.6
24	10.9	77	34.9	130	59.0	183	83.0	236	107.0
25	11.3	78	35.5	131	59.4	184	83.5	237	107.5
26	11.8	79	35.8	132	59.9	185	83.9	238	108.0
27	12.3	80	36.3	133	60.3	186	84.4	239	108.4
28	12.7	81	36.7	134	60.8	187	84.8	240	108.9
29	13.2	82	37.2	135	61.2	188	85.3	241	109.3
30	13.8	83	37.6	136	61.7	189	85.7	242	109.8
31	14.1	84	38.1	137	62.1	190	86.2	243	110.2
32	14.5	85	38.6	138	62.6	191	86.6	244	110.7
33	15.0	86	39.0	139	63.1	192	87.1	245	111.1
34	15.4	87	39.5	140	63.5	193	87.5	246	111.6
35	15.9	88	39.9	141	64.0	194	88.0	247	112.0
36	16.3	89	40.4	142	64.4	195	88.5	248	112.5
37	16.8	90	40.8	143	64.9	196	88.9	249	112.9
38	17.2	91	41.3	144	65.3	197	89.4	250	113.4
39	17.7	92	41.7	145	65.8	198	89.8	251	113.9
40	18.1	93	42.2	146	66.2	199	90.3	252	114.3
41	18.6	94	42.6	147	66.7	200	90.7	253	114.8
42	19.1	95	43.1	148	67.1	201	91.2	254	115.2
43	19.5	96	43.5	149	67.6	202	91.5	255	115.7
44	20.0	97	44.0	150	68.0	203	92.1	256	116.1
45	20.4	98	44.5	151	68.5	204	92.5	257	116.6
46	20.9	99	44.9	152	68.9	205	93.0	258	117.0
47	21.3	100	45.4	153	69.4	206	93.4	259	117.5
48	21.8	101	45.8	154	69.9	207	93.9	260	117.9
49	22.2	102	46.3	155	70.5	208	94.3	261	118.4









Equivalent weight of h2so4 calculation. Equivalent weight of citric acid calculation. Calculation of equivalent weight of salt. Calculation of equivalent weight of oxalic acid. Calculation of equivalent weight of oxidants and reductants. Formula for calculation of equivalent weight. Calculation of equivalent weight in redox reactions. Calculation of equivalent weight of kmno4.

In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. Updated March 08, 2020 By Kevin Beck Reviewed by: Lana Bandoim, B.S. When chemicals combine, they do so in known, fixed proportions. Even if you have never formally worked with chemicals yourself, you have probably seen your share of chemical reactions written out, and know that they appear in a predictable format. For example, consider the reaction of sulfuric acid and hydroxide ion to produce water and sulfate ion: H2SO4 + 2OH− → 2H2O + SO42− The numbers in front of the molecules, the coefficients, show the numbers of each reactant and product molecule in relation to each other; the subscripts within the compounds show how many atoms of each type are in a given molecule. These numbers are always integers, not fractional numbers like 4.24 or 1.3. But what do they represent? The concept of equivalent weight allows you to explore the fact that atoms combine to form molecules in fixed number ratios, not mass ratios. That is, while element masses differ, when it comes to bonding with other atoms, the number of atoms, expressed in moles, is the determining factor in how much of a given element or compound will react with a given mass of another. One mole of a substance is defined as 6.02 × 1023 individual particles (atoms or molecules) of that substance. (This happens to be the exact number of atoms in 12 grams of carbon.) As you move from left to right and downward on the periodic table, the mass of one mole of a given element, or its molecular weight (MW), is given in the corresponding box for that element, usually at center bottom. An example helps make sense of this definition. If you have one molecule of water, H2O, you can see that two H atoms react with one O atom to form this compound. But because the MW of H is about 1.0 and than of O is 16.0, you can see that the molecule contains 2(1) = 2 mass parts of H for every (1)(16) = 16 mass parts of O. Thus only 2/18 = 11/1 percent of the mass of water consists of H, while 16/198 = 88.9 percent consists of O. The equivalent weight can be thought of as the weight (or mass, to be precise) of a substance that will contain a single reactive proton (or hydrogen ion, H+) or a single reactive hydroxide ion (−OH−). The former case applies to acids, which are proton donors, while the second applies to bases, which are proton acceptors. The reason the concept of equivalent weight is needed is that some compounds can donate or accept more than one proton, meaning that for every mole present, the substance is in effect doubly reactive. The general number of equivalents formula is Where MW is the molecular weight of the compound and charge number is the number of proton- or hydroxide-equivalents the compound contains. Examples with different acids and bases help illustrate how this works in practice. Take the example of sulfuric acid from above: H2SO4 + 2OH− → 2H2O + SO42− You can calculate the MW of the acid by referring to a periodic table to get the MW of each element and adding 2(1) + (32) + 4(16) = 98.0. Note that this acid can donate two protons, as the sulfate ion is left with a charge of −2. This the equivalent weight is 98.0/2 = 49.0. For a base, the reasoning is the same. Ammonium hydroxide can accept a proton in solution to become an ammonium ion: The MW of ammonium hydroxide is (14) + (4)(1) + (16) + 1 = 35.0. Since only once proton is consumed, E for this compound is 35.0/1 = 35.0. A gram equivalent (geq) is the number of grams of substance present divided by its equivalent weight. It can also be expressed as the number of charge elements contained times the number of moles n. See the Resources for a site that allows you to automatically compute E for different molecular weights and charge combinations, or solve for any one value given the other two for any compound you can come up with. Home Science Chemistry Equivalent weight in chemistry is the most common term used and one of the basic concepts of chemistry in the physical chemistry part. An equivalent weight which is also known as gram equivalent can be defined as is the mass of one equivalent, that is the mass of a given substance that will combine with or displace a fixed quantity of another substance. Thus, in other words, gram equivalent or the equivalent weight of a substance is the mass of the substance that can displace 1.008 grams of hydrogen or 8.0 grams of oxygen or 35.5 grams of chlorine. Thus to find out the equivalent weight, the atomic weight of the substance is divided by its valence. As an example, the equivalent weight of the oxygen will be equal to 16.0 g / 2 = 8.0 g.In the acid-base reaction, the equivalent mass of an acid or base is always equal to the amount of mass that supplies or reacts with the one mole of hydrogen ion (H+). similarly, for the redox reaction, the equivalent weight of the substance is the mass that supplies or reacts with one gram mole of electrons (e-) produced in the redox reaction. It has a dimension of the unit mass that is unlike that of the atomic mass that is dimensionless in nature. The equivalent weight can be determined by the experiment and it can be determined from the molar mass of the substance. In addition, the equivalent weight can be determined by dividing the molecular mass by the number of positive or negative electrical charges that result from the dissolution of the compound.Here, we have covered the important topics related to the equivalent weight of metal. What is the equivalent weight definition in chemistry? The amount of substances that completely react with each other in the reaction is called equivalent weight in chemistry. While answering the question, what is equivalent weight? you should keep in mind that its definition depends on the two factors; the molar mass and valency factor of the compound.Equivalent Weight of Acid and baseEquivalent weight = molecular weight / XIn the above formula X represents the valency factor.For Acids:Taking an example of sulfuric acid as follows:-H2SO4 + 2OH- → 2H2O + SO42-The equivalent weight of the acid can be determined by determining the individual molecular weight of each of the elements from the periodic table and firstly adding them together. This will give us the molecular weight of the acid. 2(1) + (32) + 4(16) = 98.0.The acid is seen to be donating two protons as the sulfate ion is seen to acquire negative charges. Therefore the equivalent weight of the acid would be98.0/2 = 49.0.In the case of hydrochloric acid (HCl)HCl → H+ + Cl-The number of hydrogen ions or hydronium ions released by hydrochloric acid is one.So, the valency factor will be one.The molecular weight of hydrochloric acid = 36.45As we know, Equivalent weight = molecular weight / XThe equivalent weight of hydrochloric acid = 36.45 / 1 = 36.45For BasesThe reasoning for the base is the same. For example, ammonium hydroxide can accept a proton in solution to become an ammonium ion.NH4OH + H+ → H2O + NH4+The molecular weight of the hydroxide will be as follows.(14) + (4)(1) + (16) + 1 = 35.0. Here, since only one proton is accepted, thus the equivalent weight is equal to 35.0/1 = 35.0.For the base, X (valency factor) is the acidityAcidity- Acidity is the number of hydroxyl ions or hydroxide ions released by a base.In the case of calcium hydroxide base Ca(OH)2Ca(OH)2 →Ca+ + 2 OH-The number of hydroxyl ions released by the calcium hydroxide base is 2. Therefore, its valency factor or X value will be two.The molecular weight of the calcium hydroxide base is 74.As we know, Equivalent weight = molecular weight / XThe equivalent weight of calcium hydroxide base= 74 / 2 = 37In the case of aluminium hydroxide base Ca(OH)2Al(OH)3 → Al+3 + 3 OH-The number of hydroxyl ions released by the aluminium hydroxide base is 3. Therefore, its valency factor or X value will be three.The molecular weight of the aluminium hydroxide base is 78 g/mol.As we know, Equivalent weight = molecular weight / XThe equivalent weight of calcium hydroxide base= 78 / 3 = 26.Equivalent Weight of the Metal in Salt or Compounds 1. Aluminium ChlorideStep by Step Calculation for Finding the Equivalent Weight of Aluminium SaltsFor the metals, X (valency factor) is the total positive charge on the positive ion (cation).In the case of aluminium chloride salt Al(Cl)3AlCl3 → Al3+ + 3Cl-The number of positive charges on aluminium cation is three. Therefore, its valency factor or X value will be three.The molecular weight of the aluminium chloride base is 133.34 g/mol.As we know, Equivalent weight = molecular weight / XThe equivalent weight of aluminium chloride salt= 133.34 / 3 = 44.44. Something went wrong. Wait a moment and try again. Mass of a given substance which will combine with or displace a fixed quantity of another substance In chemistry, equivalent weight (also known as gram equivalent[1]) is the mass of one equivalent, that is the mass of a given substance which will combine with or displace a fixed quantity of another substance. The equivalent weight of an element is the mass which combines with or displaces 1.008 gram of hydrogen or 8.0 grams of oxygen or 35.5 grams of chlorine. These values correspond to the atomic weight divided by the usual valence;[2] for oxygen as example that is 16.0 g / 2 = 8.0 g. For acid–base reactions, the equivalent weight of an acid or base is the mass which supplies or reacts with one mole of hydrogen cations (H+). For redox reactions, the equivalent weight of each reactant supplies or reacts with one mole of electrons (e−) in a redox reaction.[3] Equivalent weight has the units of mass, unlike atomic weight, which is now used as a synonym for relative atomic mass and is dimensionless. Equivalent weights were originally determined by experiment, but (insofar as they are still used) are now derived from molar masses. The equivalent weight of a compound can also be calculated by dividing the molecular mass by the number of positive or negative electrical charges that result from the dissolution of the compound. In history Jeremias Benjamin Richter (1762–1807), one of the first chemists to publish tables of equivalent weights, and also the coiner of the word "stoichiometry". The first equivalent weights were published for acids and bases by Carl Friedrich Wenzel in 1777.[4] A larger set of tables was prepared, possibly independently, by Jeremias Benjamin Richter, starting in 1792.[5] However, neither Wenzel nor Richter had a single reference point for their tables, and so had to publish separate tables for each pair of acid and base.[6] John Dalton's first table of atomic weights (1808) suggested a reference point, at least for the elements: taking the equivalent weight of hydrogen to be one unit of mass.[7] However, Dalton's atomic theory was far from universally accepted in the early 19th century. One of the greatest problems was the reaction of hydrogen with oxygen to produce water. One gram of hydrogen reacts with eight grams of oxygen to produce nine grams of water, so the equivalent weight of oxygen was defined as eight grams. Since Dalton supposed (incorrectly) that a water molecule consisted of one hydrogen and one oxygen atom, this would imply an atomic weight of oxygen equal to eight. However, expressing the reaction in terms of gas volumes following Gay-Lussac's law of combining gas volumes, two volumes of hydrogen react with one volume of oxygen to produce two volumes of water, suggesting (correctly) that the atomic weight of oxygen is sixteen.[6] The work of Charles Frédéric Gerhardt (1816–56), Henri Victor Regnault (1810–78) and Stanislao Cannizzaro (1826–1910) helped to rationalise this and many similar paradoxes,[6] but the problem was still the subject of debate at the Karlsruhe Congress (1860).[8] Nevertheless, many chemists found equivalent weights to be a useful tool even if they did not subscribe to atomic theory. Equivalent weights were a useful generalisation of Joseph Proust's law of definite proportions (1794) which enabled chemistry to become a quantitative science. French chemist Jean-Baptiste Dumas (1800–84) became one of the more influential opponents of atomic theory, after having embraced it earlier in his career, but was a staunch supporter of equivalent weights. Insofar as the atomic tables have been drawn up in part following the laws of Wenzel and Richter, in part by simple speculations, they have left plenty of doubts in the best of minds. It was to escape this problem that it was attempted to deduce the atomic weights from the density of the elements in the vapour state, from their specific heat, from their crystalline form. But one must not forget that the value of the figures deduced from these properties is not in the least absolute... To sum up, what have left from this ambitious excursion that we have allowed ourselves in the realm of the atoms? Nothing, nothing necessary at the very least. What we have left is the conviction that chemistry got itself lost there, as it always does when it abandons experiment, it tried to walk without a guide through the shadows. With experiment as a guide, you find Wenzel's equivalents, Mitscherlich's equivalents, they are nothing else but molecular groups. If I had the power, I would erase the word 'atom' from science, persuaded that it oversteps the evidence of experiment; and, in chemistry, we must never overstep the evidence of experiment.— Jean-Baptiste Dumas, lecture at the Collège de France, 1843/44[6] Equivalent weights were not without problems of their own. For a start, the scale based on hydrogen was not particularly practical, as most elements do not react directly with hydrogen to form simple compounds. However, one gram of hydrogen reacts with 8 grams of oxygen to give water or with 35.5 grams of chlorine to give hydrogen chloride: hence 8 grams of oxygen and 35.5 grams of chlorine can be taken to be equivalent to one gram of hydrogen for the measurement of equivalent weights. This system can be extended further through different acids and bases.[6] Much more serious was the problem of elements which form more than one oxide or series of salts, which have (in today's terminology) different oxidation states. Copper will react with oxygen to form either brick red cuprous oxide (copper(I) oxide, with 63.5 g of copper for 8 g of oxygen) or black cupric oxide (copper(II) oxide, with 32.7 g of copper for 8 g of oxygen), and so has two equivalent weights. Supporters of atomic weights could turn to the Dulong–Petit law (1819), which relates the atomic weight of a solid element to its specific heat capacity, to arrive at a unique and unambiguous set of atomic weights.[6] Most supporters of equivalent weights - which included the great majority of chemists prior to 1860 — simply ignored the inconvenient fact that most elements exhibited multiple equivalent weights. Instead, these chemists had settled on a list of what were universally called "equivalents" (H = 1, O = 8, C = 6, S = 16, Cl = 35.5, Na = 23, Ca = 20, and so on). However, these nineteenth-century "equivalents" were not equivalents in the original or modern sense of the term. Since they represented dimensionless numbers that for any given element were unique and unchanging, they were in fact simply an alternative set of atomic weights, in which the elements of even valence have atomic weights one-half of the modern values. This fact was not recognized until much later.[9] The final death blow for the use of equivalent weights for the elements was Dmitri Mendeleev's presentation of his periodic table in 1869, in which he related the chemical properties of the elements to the approximate order of their atomic weights. However, equivalent weights continued to be used for many compounds for another hundred years, particularly in analytical chemistry. Equivalent weights of common reagents could be tabulated, simplifying analytical calculations in the days before the widespread availability of electronic calculators: such tables were commonplace in textbooks of analytical chemistry. Use in general chemistry The use of equivalent weights in general chemistry has largely been superseded by the use of molar masses. Equivalent weights may be calculated from molar masses if the chemistry of the substance is well known: sulfuric acid has a molar mass of 98.078(5) g mol−1, and supplies two moles of hydrogen ions per mole of sulfuric acid, so its equivalent weight is 98.078(5) g mol−1/2 eq mol−1 = 49.039(3) g eq−1. potassium permanganate has a molar mass of 158.034(1) g mol−1, and reacts with five moles of electrons per mole of potassium permanganate, so its equivalent weight is 158.034(1) g mol−1/5 eq mol−1 = 31.6068(3) g eq−1. Historically, the equivalent weights of the elements were often determined by studying their reactions with oxygen. For example, 50 g of zinc will react with oxygen to produce 62.24 g of zinc oxide, implying that the zinc has reacted with 12.24 g of oxygen (from the Law of conservation of mass): the equivalent weight of zinc is the mass which will react with eight grams of oxygen, hence 50 g × 8 g/12.24 g = 32.7 g. Some contemporary general chemistry textbooks make no mention of equivalent weights.[10] Others explain the topic, but point out that it is merely an alternate method of doing calculations using moles.[11] Use in volumetric analysis Burette over a conical flask with phenolphthalein indicator used for acid–base titration When choosing primary standards in analytical chemistry, compounds with higher equivalent weights are generally more desirable because weighing errors are reduced. An example is the volumetric standardisation of a solution of sodium hydroxide which has been prepared to approximately 0.1 mol dm−3. It is necessary to calculate the mass of a solid acid which will react with about 20 cm3 of this solution (for a titration using a 25 cm3 burette): suitable solid acids include oxalic acid dihydrate, potassium hydrogen phthalate and potassium hydrogen iodate. The equivalent weights of the three acids 63.04 g, 204.23 g and 389.92 g respectively, and the masses required for the standardisation are 126.1 mg, 408.5 mg and 779.8 mg respectively. Given that the measurement uncertainty in the mass measured on a standard analytical balance is ±0.1 mg, the relative uncertainty in the mass of oxalic acid dihydrate would be about one part in a thousand, similar to the measurement uncertainty in the volume measured in the titration.[12] However the measurement uncertainty in the mass of potassium hydrogen iodate would be five times lower, because its equivalent weight is five times higher: such an uncertainty in the measured mass is negligible in comparison to the uncertainty in the volume measured during the titration (see example below). For sake of example, it shall be assumed that 22.45±0.03 cm3 of the sodium hydroxide solution reacts with 781.4±0.1 mg of potassium hydrogen iodate. As the equivalent weight of potassium hydrogen iodate is 389.92 g, the measured mass is 2.004 milliequivalents. The concentration of the sodium hydroxide solution is therefore 2.004 meq/0.02245 l = 89.3 meq/l. In analytical chemistry, a solution of any substance which contains one equivalent per litre is known as a normal solution (abbreviated N), so the example sodium hydroxide solution would be 0.0893 N.[3][13] The relative uncertainty (ur) in the measured concentration can be estimated by assuming a Gaussian distribution of the measurement uncertainties: u r 2 = (u (V) V) 2 + (u (m) m) 2 = (0.03 22.45) 2 + (0.1 781.4) 2 = (0.001336) 2 + (0.000128) 2 u r = 0.00134 u (c) = u r c = 0.1 m e q / l {\displaystyle {\begin{aligned}u_{\rm {r}}^{2}&=\left({\frac {u(V)}{V}}\right)^{2}+\left({\frac {u(m)}{m}}\right)^{2}\\&=\left({\frac {0.03}{22.45}}\right)^{2}+\left({\frac {0.1}{781.4}}\right)^{2}\\&=(0.001336)^{2}+(0.000128)^{2}\\u_{\rm {r}}&=0.00134\\u(c)&=u_{\rm {r}}c=0.1\ {\rm {meq/l}}\end{aligned}}} This sodium hydroxide solution can be used to measure the equivalent weight of an unknown acid. For example, if it takes 13.20±0.03 cm3 of the sodium hydroxide solution to neutralise 61.3±0.1 mg of an unknown acid, the equivalent weight of the acid is: equivalent weight = m acid c (NaOH) V eq = 52.0 ± 0.1 g {\displaystyle {\text{equivalent weight}}={\frac {m_{{\ce {acid}}}}{c({\ce {NaOH}})V_{{\ce {eq}}}}}=52.0\pm 0.1\ {\ce {g}}} Because each mole of acid can only release an integer number of moles of hydrogen ions, the molar mass of the unknown acid must be an integer multiple of 52.0±0.1 g. Use in gravimetric analysis Powdered bis(dimethylglyoximate)nickel. This coordination compound can be used for the gravimetric determination of nickel. The term "equivalent weight" had a distinct sense in gravimetric analysis: it was the mass of precipitate which corresponds to one gram of analyte (the species of interest). The different definitions came from the practice of quoting gravimetric results as mass fractions of the analyte, often expressed as a percentage. A related term was the equivalence factor, one gram divided by equivalent weight, which was the numerical factor by which the mass of precipitate had to be multiplied to obtain the mass of analyte. For example, in the gravimetric determination of nickel, the molar mass of the precipitate bis(dimethylglyoximate)nickel [Ni(dmgH)2] is 288.915(7) g mol−1, while the molar mass of nickel is 58.6934(2) g mol−1: hence 288.915(7)/58.6934(2) = 4.9224(1) grams of [Ni(dmgH)2] precipitate is equivalent to one gram of nickel and the equivalence factor is 0.203151(5). For example, 215.3±0.1 mg of [Ni(dmgH)2] precipitate is equivalent to (215.3±0.1 mg) × 0.203151(5) = 43.74±0.2 mg of nickel: if the original sample size was 5.346±0.001 g, the nickel content in the original sample would be 0.8182±0.0004%. Gravimetric analysis is one of the most precise of the common methods of chemical analysis, but it is time-consuming and labour-intensive. It has been largely superseded by other techniques such as atomic absorption spectroscopy, in which the mass of analyte is read off from a calibration curve. Use in polymer chemistry Beads of an ion-exchange polymer. In polymer chemistry, the equivalent weight of a reactive polymer is the mass of polymer which has one equivalent of reactivity (often, the mass of polymer which corresponds to one mole of reactive side-chain groups). It is widely used to indicate the reactivity of polyol, isocyanate, or epoxy thermoset resins which would undergo crosslinking reactions through those functional groups. It is particularly important for ion-exchange polymers (also called ion-exchange resins): one equivalent of an ion-exchange polymer will exchange one mole of singly charged ions, but only half a mole of doubly charged ions.[14] Nevertheless, given the decline in use of the term "equivalent weight" in the rest of chemistry, it has become more usual to express the reactivity of a polymer as the inverse of the equivalent weight, that is in units of mmol/g or meq/g.[15] References

^ gram equivalent Merriam-Webster Dictionary ^ Equivalent weight chemistry Encyclopædia Britannica ^ a b International Union of Pure and Applied Chemistry (1998). Compendium of Analytical Nomenclature (definitive rules 1997, 3rd. ed.). Oxford: Blackwell Science. ISBN 0-86542-6155. section 6.3. "Archived copy" (PDF). Archived from the original (PDF) on July 26, 2011. Retrieved 2009-05-10.{{cite web}}: CS1 maint: archived copy as title (link) ^ Wenzel, Carl Friedrich (1777). Lehre von der Verwandtschaft der Körper [Theory of the Affinity of Bodies (i.e., substances)] (in German). Dreßden, (Germany): Gotthelf August Gerlach. ^ Richter, J.B. (1792–1794). Anfangsgründe der Stöchyometrie ... (3 vol.s) [Rudiments of Stoichiometry ...] (in German). Breslau and Hirschberg, (Germany): Johann Friedrich Korn der Aeltere. ^ a b c d e f Atome Grand dictionnaire universel du XIXe siècle (editeur Pierre Larousse, Paris 1866, vol.1, pages 868-73)(in French) ^ Dalton, John (1808). A New System of Chemical Philosophy. London, England: R. Bickerstaff. p. 219. ^ See Charles-Adolphe

Wurtz's report on the Karlsruhe Congress. ^ Alan J. Rocke, Chemical Atomism in the Nineteenth Century: From Dalton to Cannizzaro (Ohio State University Press, 1984). ^ For example, Petrucci, Ralph H.; Harwood, William S.; Herring, F. Geoffrey (2002). General Chemistry (8th ed.). Prentice-Hall. ISBN 0-13-014329-4. ^ Whitten, Kenneth W.; Gailey, Kenneth D.; Davis, Raymond E. (1992). General Chemistry (4th ed.). Saunders College Publishing. p. 384. ISBN 0-03-072373-6. Any calculation that can be carried out with equivalent weights and normality can also be done by the mole method using molarity. ^ ISO 385:2005 "Laboratory glassware – burettes". ^ The use of the term "normal solution" is no longer recommended by IUPAC. ^ IUPAC, Compendium of Chemical Terminology, 2nd ed. (the "Gold Book") (1997). Online corrected version: (2006–) "equivalent entity". doi:10.1351/goldbook.E02192 ^ See, e.g., Ion Exchange Resins: Classification and Properties (PDF), Sigma-Aldrich, archived from the original (PDF) on 10 December 2015, retrieved 14 April 2009 Retrieved from "

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