

SIMPLE FIELD TEST FOR DISTINGUISHING MINERALS BY ABRASION pH*

ROLLIN E. STEVENS AND MAXWELL K. CARRON

ABSTRACT

A simple field test is described for distinguishing minerals by estimating the pH of suspensions made by grinding them in water. The term abrasion pH is proposed to designate the pH values obtained by this grinding technique, which may differ from pH values obtained by shaking previously ground minerals in water. Soft minerals are scratched in one or two drops of water on a streak plate for about a minute to form a milky suspension and the resulting pH of the solution estimated with indicator papers. Hard minerals and those that absorb water are ground with a few drops of water in an agate mortar for about a minute. Abrasion pH values are given for about 280 mineral species, many of them confirmed repeatedly by determinations on specimens from different localities. Abrasion pH values of minerals range from 1 to 12. Many minerals whose compositions vary because of isomorphous replacements yield a range of values that reflect the varying content of alkali- or acid-forming materials, whereas minerals of fixed compositions show little variation in abrasion pH for each mineral species. Many minerals similar in appearance but differing in composition are easily distinguishable by the abrasion pH test, for example calcite from dolomite or magnesite, talc from pyrophyllite, and muscovite from phlogopite.

INTRODUCTION

Although frequently simple tests in the field may be sufficient to identify a mineral definitely, some specimens may require study of their optical properties and chemical composition in the laboratory before their identity or value can be established. Any additional property by which minerals can be definitely identified in the field, therefore, seems worthy of the attention of geologists and mineralogists.

The abrasion pH of a mineral is a property that can be estimated easily and quickly for field identification of a specimen. Although the precise determination of the pH of solutions requires considerable equipment, an estimate can be obtained by simple means. In the technique described below for the determination of abrasion pH the only equipment needed is a porcelain streak plate, small agate mortar and pestle, pH indicator papers, and distilled water or water of low salinity.

The alkaline reaction of some minerals has been noted in previous investigations. Kenngott¹ found that many silicates give alkaline reactions

* Published by permission of the Director, U. S. Geological Survey, Washington, D. C.

¹ Kenngott, A., Über einige Erscheinungen beobachtet an Natrolith: *Neues Jahrb.*, 77 (1867).

to moistened test paper. Clarke² treated a number of powdered silicate minerals with water containing phenolphthalein, noting the intensity of color produced, and thus determined roughly the extent to which they were decomposed. Analyses by Steiger³ showed a discrepancy between the intensity of the color and the quantity of alkali found in solution.

Atkins⁴ discussed the application of pH to the study of geological problems and made several measurements on minerals. Stevens⁵ made colorimetric and electrometric pH measurements on silicate minerals crushed in water. Umegaki⁶ studied the pH values of water suspensions of plagioclase feldspars and carbonate minerals, which were first ground in air to pass a 200 mesh sieve and shaken with water for varying time intervals.

COMPARISON OF RESULTS BY DIFFERENT METHODS OF ATTACK. DEFINITION OF ABRASION PH.

The pH values presented in this paper and those previously reported by Stevens⁵ on silicates of alkaline reaction are generally higher than the carefully determined values of Umegaki.⁶ Probably this discrepancy is due to the different methods of attack of the minerals. Umegaki's results were obtained by placing the previously ground mineral in water and shaking for as long as 2½ hours, whereas the results here reported were determined by grinding the mineral in water. In grinding the mineral in water increased hydrolysis results from the continuous exposure of new surfaces to attack and perhaps from localized rise in temperature and pressure during the abrasion of the mineral grains.

Because of these discrepancies, apparently resulting from different methods of attacking the mineral, the term abrasion pH is adopted in the present study to designate the pH resulting from grinding the mineral under water.

HYDROLYSIS OF MINERALS

In an elementary treatment, salts may be considered the product of the reaction between an acid and an alkali. Thus, representing a hypo-

² Clarke, F. W., The alkaline reaction of some natural silicates: *U. S. Geol. Survey, Bull.* **167**, 156-158 (1900).

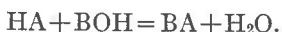
³ Steiger, George, The solubility in water of certain natural silicates: *U. S. Geol. Survey, Bull.* **167**, 159-160 (1900).

⁴ Atkins, W. R. G., Some geochemical applications of measurements of hydrogen-ion concentration: *Roy. Dublin Soc. Sci. Proc.*, **19**, 455-460 (1930).

⁵ Stevens, R. E., Studies on the alkalinity of some silicate minerals: *U. S. Geol. Survey, Prof. Paper* **185A**, 1-13 (1934-1935).

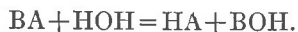
⁶ Umegaki, Yosiharu, Über die bei der Hydrolyse der Plagioklase und einiger Karbonatminerale nachgewiesene Wasserstoffion-Konzentration: *Mem. Coll. Sci., Kyoto Imp. Univ.*, **14**, 141-154 (1938).

thetical acid by HA and a hypothetical alkali by BOH their reaction may be represented as follows:

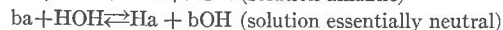
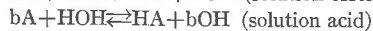
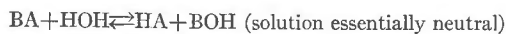


The salt formed is a combination of elements in simple proportion, and, in the above reaction, the salt (BA) consists of an equal number of atoms of element B and of element A.

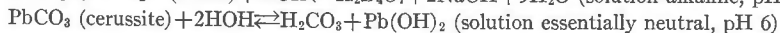
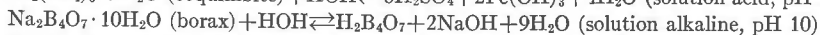
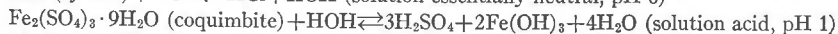
The hydrolysis of a salt may be represented as the reverse of the above reaction thus:



As the acid (HA) and the alkali (BOH) are thus produced in equal molecular quantities the acidity or alkalinity of the resulting solution is dependent upon the extent to which the acid is ionized to yield hydrogenions and the alkali is ionized to yield hydroxyl-ions. Representing a strongly ionized acid by HA and a weakly ionized one by Ha, and a strong and a weak alkali by BOH and bOH respectively, the hypothetical salts BA, bA, Ba, and ba hydrolyze as follows:



As examples of the above types of hydrolysis the following reactions of minerals with water may be cited:



In addition to the above types of materials, there are acid and basic salts whose pH in water is dependent not only upon the ionization of the acids and alkalis formed by hydrolysis but also upon the proportion of acid- or alkali-producing constituents, in the salt. Thus K_2SO_4 is essentially neutral, but KHSO_4 has a strong acid reaction. Weak acids and weak bases also occur as minerals, examples being H_3BO_3 (sassolite) and $\text{Al}(\text{OH})_3$ (gibbsite), which give essentially neutral reactions in water.

This discussion of the elementary theoretical background of the test shows that the abrasion pH of a mineral may indicate its composition type and identity. Thus a mineral giving an abrasion pH of 2 is generally a salt of a weak alkali and a strong acid. However, other factors which may contribute to the result of the test are hardness and nonreactivity, cleavage in relation to the positions of atoms and impurities.

Many interesting differences in abrasion pH result from the substitution of one element for another in a mineral. Thus pyrophyllite, $\text{Al}_2\text{Si}_4\text{O}_{10}(\text{OH})_2$, gives abrasion pH of 6, while its magnesium analogue talc, $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$, gives pH 9. Increasing substitution of Li for Al in lepidolite raises the abrasion pH of that mineral.

PROCEDURES FOR MAKING MINERAL SUSPENSIONS
FOR ABRASION pH DETERMINATIONS.

With streak plate: For soft non-absorbent minerals scratch the mineral in a drop of water* on a streak plate for about a minute to form a milky suspension. Determine the abrasion pH with the appropriate indicator papers.

With mortar and pestle: For hard minerals and those that absorb water, grind fragments of the mineral for a minute with a few drops of water to make a heavy suspension and apply the indicator papers.

pH indicator papers: The abrasion pH may be determined in the laboratory either by the use of indicators in solution or by indicator papers. As indicator papers have obvious advantages for field work, they have been used in the present study.

Extensive lists of pH indicators are given by Clark,⁷ Britton,⁸ and in the Handbook of Chemistry and Physics⁹ of the Chemical Rubber Co. Lange's Handbook of Chemistry¹⁰ gives lists of indicators and an illustrative chart showing the pH ranges of various indicators. In most colorimetric pH work, in which buffer solutions are used for standards of comparison the entire range of color change is used for estimation of pH. In the present study the point at which an indicator changes from one color to another was found to be most useful as indicating a pH above or below a certain value. For example, pyrophyllite (pH 6) changes phenol red paper to yellow, indicating a pH below 6.8, whereas talc (pH 9) turns this indicator red. Other indicators with useful color changes are: thymol blue—red below pH 2.8, yellow above; methyl orange—red below pH 4.4, yellow above; brom thymol blue—yellow below pH 6.0, blue above; methyl red—red below pH 6.3, yellow above; phenol red—yellow be-

* Most of the tests here recorded were made with Washington, D. C., tap water, which is essentially neutral and gave abrasion pH values identical with distilled water. In the field natural waters may be used. Waters of high alkalinity, acidity, or salinity should not be used.

⁷ Clark, W. Mansfield, The determination of hydrogen ions, 3rd ed., pp. 76-94, Baltimore, The Williams and Wilkins Company (1928).

⁸ Britton, H. T. S., Hydrogen ions, 2nd ed., London, Chapman and Hall (1932).

⁹ Handbook of Chemistry and Physics, 29th ed., 1363-1366, Cleveland, Ohio, Chemical Rubber Publishing Co. (1945).

¹⁰ Lange's Handbook of Chemistry, p. 904, Sandusky, Ohio, Handbook Publishers, Inc. (1937).

low pH 6.8, red above; thymol blue—yellow below pH 8.0, blue above; phenolphthalein—colorless below pH 8.3, red above; alizarin yellow R—yellow below pH 10.1, orange above; Poirrier's blue—blue below pH 11.0, red above.

These indicators may be made up in solution as described by Clark, and strips of filter paper dipped therein and dried.

Prepared indicator papers may be purchased. Accutint papers, prepared by Anachemia, Ltd., Montreal, Canada, have been used extensively in this study. These papers are bound in small booklet form and a color chart for making the estimations is provided. Three wide-range Accutint papers are used for rough estimation and twenty short-range papers allow more precise measurements. pHydrión papers, distributed by Palo-Myers, Inc., New York City, are furnished in a convenient transparent plastic dispenser and consist of 2 wide-range papers covering all pH values, and 6 short-range papers. Nitrazine papers covering the pH range 4.5 to 7.5 are distributed by E. R. Squibb and Sons, New York. These are a few of the many brands of pH indicator papers available.

In using these papers for abrasion pH determinations they are dipped in the mineral suspension and removed to observe the color, mineral particles being retained on the under surface of the paper. Maximum deviation from neutrality is noted in making color comparisons with the chart. Suspensions of many minerals exhibit this maximum deviation on the paper only close to the mineral particles.

DETERMINATIONS OF ABRASION pH OF MINERALS.

Determinations of abrasion pH of a number of minerals are listed in table 1. In all, 280 minerals have been studied, many of the determinations repeatedly confirmed by results obtained on numerous specimens from different localities. In the table, the minerals giving various abrasion pH values are listed (alphabetically for each pH value), the number of specimens giving the specified values are noted, and abrasion pH values found for other specimens in the present study are given. At the end of the table is an index to the abrasion pH of the various mineral species.

The abrasion pH of minerals has been found to range from pH 1 to pH 12. Many of the mineral species do not vary in abrasion pH from specimen to specimen, whereas others may vary by as much as two or three units. For example, pyrophyllite which is essentially fixed in composition, $\text{Al}_2\text{Si}_4\text{O}_{10}(\text{OH})_2$, gave consistently abrasion pH 6, whereas lepidolite, in which isomorphous substitution of Li for Al is known to occur, gave abrasion pH values of 8 to 9, the higher value representing samples highest in lithium. Biotite, a mineral in which Mg and Fe sub-

stitute for each other varied in abrasion pH between 8 and 9, and phlogopite, the magnesium end-member of the series, gave abrasion pH values of 10 and 11.

The abrasion pH of the carbonate minerals of calcium and magnesium should be a useful test for differentiating these minerals in the field. Calcite gives consistently an abrasion pH of around 8, dolomite 9 to 10, and magnesite 10 to 11, thus enabling calcite to be quickly differentiated from these magnesium-containing carbonates. Several indicators are useful for this purpose, the best being phenolphthalein paper. With this indicator paper the abrasion test of calcite gives a colorless reaction (pH below 8.3), whereas dolomite and magnesite give an intense red color. Differentiation between dolomite and magnesite is not as definite, differences in abrasion pH being not as great and the available indicators in that range not as satisfactory.

It was hoped that sufficient differences in abrasion pH would be found to identify the different minerals of the plagioclase feldspar series. However, the calcium end-member, anorthite, $\text{CaAl}_2\text{Si}_2\text{O}_8$, gives an abrasion pH of 8 and the sodium end-member, albite, $\text{NaAlSi}_3\text{O}_8$, gives values ranging between 9 and 10. The spread in abrasion pH between the two end-members is not wide enough for differentiation of the intermediate plagioclase feldspars.

The differences in abrasion pH are further shown in Fig. 1, illustrating values found for representative minerals. This chart is similar to those published elsewhere to show pH ranges of indicators. The close interdependence of composition to abrasion pH can be readily seen.

The distribution in abrasion pH for the 280 different mineral species tested is illustrated in Fig. 2. Most minerals are nearly neutral or alkaline in reaction.

It is interesting to note that many of the pH groups contain minerals closely associated geologically. Thus minerals giving abrasion pH 1, 2 and 3 are the sulfates commonly formed when the acid solutions from oxidation of pyrite decompose aluminous rocks. Minerals of abrasion pH 10 include numerous borates and a number of minerals found in contact limestones (albite, amphibole, chondrodite, diopside, dolomite, hornblende, idocrase, monticellite, olivine, pectolite, phlogopite, picrolite, prehnite, pyroxene, serpentine, tremolite, and xonotlite). Those of abrasion pH 11 include several rare minerals usually found together, such as hillebrandite, merwinite, thaumasite, spurrite, etc. Soda lime carbonates, which occur together in nature, give abrasion pH 12. In a recent study of the biotite-phlogopite series of micas Heinrich¹¹ shows that high-

¹¹ Heinrich, E. Wm., Studies in the mica group; the biotite-phlogopite series: *Am. Jour. Sci.*, **244**, 836-848 (1946).

MINERAL	COMPOSITION	COMPOSITION TYPE A - strong acid B - strong base a - weak acid b - weak base	Abrasion pH											
			a c i d						n e u t r a l		a l k a l i n e			
			1	2	3	4	5	6	7	8	9	10	11	12
Caquimbite	$F_6(SO_4)_2 \cdot 9H_2O$	b A	■											
Alenogen	$Al_2SiO_4 \cdot 16H_2O$	b A		■										
Pickeringite	$MgAl_2(SO_4)_6 \cdot 22H_2O$	B b A			■									
Potash Alum	$KAl(SO_4)_2 \cdot 12H_2O$	B b A				■								
Aluminite	$Al_2SO_4 \cdot 9H_2O$	b A					■							
Scorodite	$FeAsO_4 \cdot 2H_2O$	b A						■						
Saesolite	H_2BO_3	a							■					
Jarosite	$K_2Fe_6(OH)_2(SO_4)_6$	b a								■				
Siderite	$FeCO_3$	b a									■			
Gypsum	$CaSO_4 \cdot 2H_2O$	B A										■		
Pyrophyllite	$Al_2Si_4O_{10}(OH)_2$	b a											■	
Quartz	SiO_2	a												■
Gibbsite	$Al(OH)_3$	b												■
Andalusite	Al_2SiO_5	b a												■
Muscovite	$KAl_2Si_2O_8(OH)_2$	B b a												■
Calcite	$CaCO_3$	B a												■
Anorthite	$CaAl_2Si_2O_8$	B b a												■
Microcline	$KAlSi_3O_8$	B b a												■
Talc	$Mg_3Si_4O_{10}(OH)_2$	B a												■
Albite	$NaAlSi_3O_8$	B b a												■
Dolomite	$CaMg(CO_3)_2$	B b a												■
Borax	$H_2B_4O_7 \cdot 10H_2O$	B a												■
Phlogopite	$KMg_3Si_3O_{10}(OH)_2$	B b b a												■
Magnesite	$MgCO_3$	B a												■
Brucite	$Mg(OH)_2$	B												■
Merwinite	$CaMg(SiO_3)_2$	B b a												■
Storite	$Na_2Ca_2(CO_3)_2$	B b a												■

Fig. 1. Abrasion pH values of representative minerals.

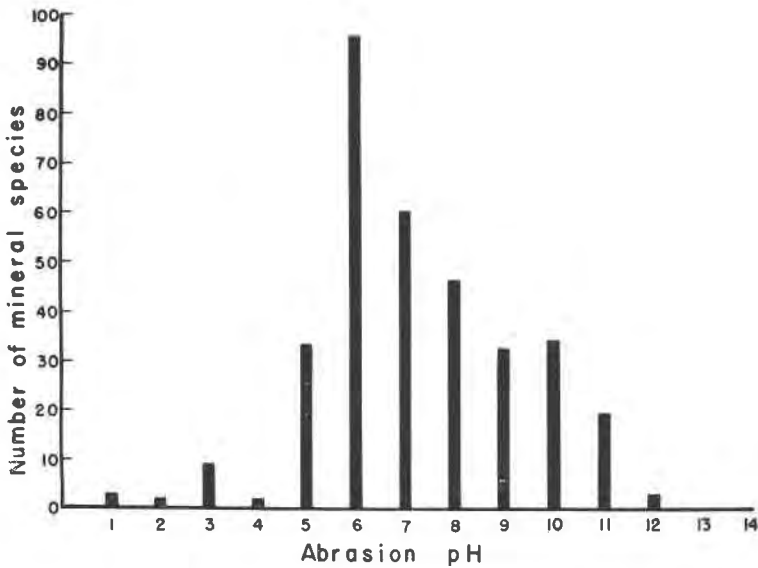


FIG. 2. Abrasion pH distribution of mineral species tested.

iron biotites are associated with the less basic rocks, such as granitic pegmatites, granites, etc., while phlogopites are found in more basic rocks, such as gabbro, peridotite and other ultramafics, and metamorphosed limestones. This occurrence together of minerals of equal abrasion pH is probably not as common for minerals of igneous origin as for those formed in hydrous environments.

ACKNOWLEDGMENT

The authors wish to express their gratitude to a number of members of the staff of the Geological Survey for invaluable aid in preparing this study, particularly to W. T. Schaller, J. M. Axelrod, G. T. Faust, N. Davidson, K. J. Murata, J. J. Fahey, C. Milton, M. D. Foster, W. G. Schlecht, Michael Fleischer, and Earl Ingerson.

ABRASION pH OF MINERALS

	<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
<i>pH 1</i>	Coquimbite	$\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$	1	
	Kornelite	$\text{Fe}_2(\text{SO}_4)_3 \cdot 7\frac{1}{2}\text{H}_2\text{O}$	1	
	Rhomboclase	$\text{FeH}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$	1	
<i>pH 2</i>	Alunogen	$\text{Al}_2(\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}$	1	
	Melanterite	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	1	3
<i>pH 3</i>	Alum	$\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	2	
	Botryogen	$\text{Mg}_2\text{Fe}_2(\text{SO}_4)_4(\text{OH})_2 \cdot 14\text{H}_2\text{O}$	1	
	Copiapite	$\text{Fe}_4(\text{OH})_2(\text{SO}_4)_5 \cdot 18\text{H}_2\text{O}$	1	
	Halotrichite	$\text{FeAl}_2(\text{SO}_4)_4 \cdot 22\text{H}_2\text{O}$	1	
	Melanterite	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	1	2
	Pickeringite	$\text{MgAl}_2(\text{SO}_4)_4 \cdot 22\text{H}_2\text{O}$	9	
	Redingtonite	$(\text{Fe}, \text{Mg})(\text{Al}, \text{Cr})_2(\text{SO}_4)_4 \cdot 22\text{H}_2\text{O}$	2	
	Tschermigite	$\text{NH}_4\text{Al}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	2	
	Vanoxite	$2\text{V}_2\text{O}_4 \cdot \text{V}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$	1	
	<i>pH 4</i>	Aluminite	$\text{Al}_2\text{SO}_6 \cdot 9\text{H}_2\text{O}$	1
Turquoise		$\text{H}_5(\text{CuOH})[\text{Al}(\text{OH})_2]_6(\text{PO}_4)_4$	1	6
<i>pH 5</i>	Anglesite	PbSO_4	2	
	Blomstrandite	Titanocolumbate of U, Th, Y, Er, Ce, etc.	1	
	Carnallite	$\text{KMgCl}_3 \cdot 6\text{H}_2\text{O}$	1	
	Celestite	SrSO_4	2	6
	Cotunnite (art.)	PbCl_2	1	
	Cyrtolite	Altered ZrSiO_4	2	6, 7
	Diadochite	Basic iron sulfate-phosphate	2	
	Evansite	$2\text{AlPO}_4 \cdot 4\text{Al}(\text{OH})_3 \cdot 12\text{H}_2\text{O}$	1	
	Glauconite	$\text{K}_2(\text{Mg}, \text{Fe})_2\text{Al}_6(\text{Si}_4\text{O}_{10})_3(\text{OH})_2$	1	
	Jarosite	$\text{K}_2\text{Fe}_6(\text{OH})_{12}(\text{SO}_4)_4$	4	6
	Kaolinite	$\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$	1	6, 7
	Minervite	Hydrous phosphate of K and Al	1	

<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasions pH value</i>
Monazite	Essentially (Ce, La, Pr, Nd)PO ₄	2	6
Nontronite	FeSi ₂ O ₅ (OH) · nH ₂ O	2	6
Paligorskite	Hydrous Mg Al silicate	1	7
Plumbojarosite	PbFe ₆ (OH) ₁₂ (SO ₄) ₄	1	
Polyhalite	2CaSO ₄ · MgSO ₄ · K ₂ SO ₄ · 2H ₂ O	2	6
Pseudobolélite	5PbCl ₂ · 4CuO · 6H ₂ O	1	
Pseudowavellite	CaAl ₃ (PO ₄) ₂ (OH) ₅ · H ₂ O	1	
Rectorite	Appx. NaAl ₅ Si ₇ O ₂₀ (OH) ₄ · 4H ₂ O	1	
Rhagite	2BiAsO ₄ · 3Bi(OH) ₃	1	
Sassolite	H ₃ BO ₃	3	
Scorodite	FeAsO ₄ · 2H ₂ O	2	
Siderite	FeCO ₃	1	6, 7
Spencerite	Zn(PO ₄) ₂ · Zn(OH) ₂ · 3H ₂ O	1	
Sphalerite	ZnS	1	6
Staurolite	FeAl ₄ Si ₂ O ₁₀ (OH) ₂	1	6, 7
Stibiotantalite	Sb ₂ (Ta, Cb) ₂ O ₈	1	
Uraninite			
(pitchblende)	UO ₂	1	6
Vanadinite	3Pb ₃ V ₂ O ₈ · PbCl ₂	2	6
Variscite	AlPO ₄ · 2H ₂ O	1	6
Vivianite	Fe ₃ P ₂ O ₈ · 8H ₂ O	2	
Wavellite	4AlPO ₄ · 2Al(OH) ₃ · 9H ₂ O	1	
pH 6 Alunite	KAl ₆ (OH) ₁₂ (SO ₄) ₄	5	
Anhydrite	CaSO ₄	4	
Arseniosiderite	Ca ₃ Fe(AsO ₄) ₃ · 3Fe(OH) ₃	1	
Barite	BaSO ₄	1	
Bastnaesite	(Ce, La, Pr, Nd)FCO ₃	1	
Beaverite	CuO · PbO · Fe ₂ O ₃ · 2SO ₃ · 4H ₂ O	1	
Beryl	Be ₃ Al ₂ Si ₆ O ₁₈	6	7
Betafite	Titanocolumbate of U, etc.	6	
Bismutite	Bi ₂ CO ₅ · H ₂ O	1	
Bloedite	MgSO ₄ · Na ₂ SO ₄ · 4H ₂ O	1	
Boehmite	AlO(OH)	1	7
Bolélite	9PbCl ₂ · 8CuO · 3AgCl · 9H ₂ O	1	
Brookite	TiO ₂	1	
Cassiterite	SnO ₂	2	
Celestite	SrSO ₄	2	5
Cerussite	PbCO ₃	1	
Chrysoberyl	BeAl ₂ O ₄	1	7
Chrysocolla	CuSiO ₃ · 2H ₂ O	1	
Columbite	(Fe, Mn)(Cb, Ta) ₂ O ₆	1	
Cryolite	Na ₃ AlF ₆	1	7
Cuprotungstite	Cu ₂ WO ₅ · H ₂ O	1	
Cyrtolite	Altered ZrSiO ₄	1	5, 7
Descloisite	PbZnVO ₄ (OH)	1	
Diaspore	HAIO ₂	3	7
Dickite	Al ₂ Si ₂ O ₅ (OH) ₄	7	

<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
Dumortierite	$Al_3BSi_3O_{19}(OH)$	4	7
Eosphorite	$AlPO_4 \cdot Mn(OH)_2 \cdot H_2O$	1	
Euxenite	Columbate and titanothorate of Y, Er, Ce, U	1	
Fayalite	Fe_2SiO_4	1	
Flajolotite	$4FeSbO_4 \cdot 3H_2O$	1	
Francolite	$3Ca_3P_2O_8 \cdot Ca[F_2, (OH)_2, CO_3]$	1	7
Fremontite	$(Na, Li)Al(OH, F)PO_4$	1	
Gibbsite	$Al(OH)_3$	1	7
Glauberite	$Na_2SO_4 \cdot CaSO_4$	2	
Greenalite	Hydrous ferrous silicate	1	
Gypsum	$CaSO_4 \cdot 2H_2O$	12	
Halite	NaCl	9	
Halloysite	$Al_2Si_2O_6(OH)_4 + H_2O$	4	
Hematite	Fe_2O_3	1	
Hemimorphite	$Zn_2SiO_3(OH)_2$	2	7
Herderite	$CaBe(F, OH)PO_4$	1	
Hinsdalite	$2PbO \cdot 3Al_2O_3 \cdot P_2O_5 \cdot 2SO_3 \cdot 6H_2O$	1	
Huebnerite	$MnWO_4$	3	
Hureaulite	$H_2Mn_5(PO_4)_4 \cdot 4H_2O$	1	
Ilmenite	$FeTiO_3$	2	
Ilmenorutile	$TiO_2 \cdot nFe(Cb, Ta)_2O_6$	1	
Jarosite	$K_2Fe_6(OH)_{12}(SO_4)_4$	1	5
Kaolinite	$Al_2Si_2O_5(OH)_4$	1	5, 7
Kieserite	$MgSO_4 \cdot H_2O$	1	
Kyanite	Al_2SiO_5	4	
Langbeinite	$K_2Mg_2(SO_4)_3$	1	
Lanthanite	$(La, Pr, Nd, Ce)_2(CO_3)_3 \cdot 8H_2O$	1	
Lepidocrocite	$FeO(OH)$	1	
Manganotantalite	$(Fe, Mn)(Cb, Ta)_2O_6$	1	
Mirabilite	$Na_2SO_4 \cdot 10H_2O$	1	
Monazite	$(Ce, La, Pr, Nd)PO_4$	1	5
Montmorillonite	$(Al_2, Mg_3)Si_4O_{10}(OH)_2 \cdot nH_2O$	2	7
Montmorillonite (Bentonite)	Ditto	2	
Mottramite	$PbCuVO_4(OH)$	2	
Nitre	KNO_3	2	
Nitrocalcite	$Ca(NO_3)_2 \cdot 4H_2O$	1	
Nontronite	$FeSi_2O_6(OH) \cdot nH_2O$	3	5
Olivenite	$Cu_3As_2O_8 \cdot Cu(OH)_2$	1	
Opal	$SiO_2 \cdot nH_2O$	1	7
Pinite	Near muscovite	1	
Planchéite	$3CuSiO_3 \cdot H_2O$	1	
Polyhalite	$2CaSO_4 \cdot MgSO_4 \cdot K_2SO_4 \cdot 2H_2O$	1	5
Pyrophyllite	$Al_2Si_4O_{10}(OH)_2$	9	
Quartz	SiO_2	1	7
Quartz (amethyst)	SiO_2	1	7

<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
Reddingite	$Mn_3P_2O_8 \cdot 3H_2O$	1	
Rhodochrosite	$MnCO_3$	1	7
Rutile	TiO_2	1	7
Salammoniac	NH_4Cl	1	
Samarskite	(Y, Er, Ce, U, Ca, Fe, Pb, Th) (Cb, Ta, Ti, Sn) $_2O_6$	4	
Scheelite	$CaWO_4$	3	7
Siderite	$FeCO_3$	2	5, 7
Soda nitre	$NaNO_3$	1	
Sphalerite	ZnS	1	5
Staurolite	$FeAl_2Si_2O_{10}(OH)_2$	2	5, 7
Sulfur	S	1	
Sylvite	KCl	2	
Tantalite	(Fe, Mn)(Cb, Ta) $_2O_6$	1	
Thorotungstite	W and Th oxides	1	
Topaz	$Al_2SiO_4(F, OH)_2$	1	7
Torbernite	$Cu(UO_2)_2P_2O_8 \cdot 8H_2O$	1	
Triplite	(Fe, Mn, Mg)PO ₄ F	1	
Tungstite	$WO_3 \cdot H_2O$	1	
Turquoise	$H_5(CuOH)[Al(OH)_2]_6(PO_4)_4$	2	4
Uraninite (pitchblende)	UO ₂	2	5
Vanadinite	$3Pb_2V_2O_8 \cdot PbCl_2$	1	5
Vanthoffite	$3Na_2SO_4 \cdot MgSO_4$	1	
Variscite (lucinite)	$AlPO_4 \cdot 2H_2O$	1	5
Wolframite	(Fe, Mn)WO ₄	1	
Wulfenite	$PbMoO_4$	1	
Zircon	ZrSiO ₄	2	
pH 7 Allanite	(Ca, Ce, La, Na) ₂ (Al, Fe, Mn, Be, Mg) ₃ (SiO ₄) ₃ OH	2	8
Andalusite	Al_2SiO_5	4	
Annabergite	$Ni_3As_2O_8 \cdot 8H_2O$	1	
Aurichalcite	$2(Zn, Cu)CO_3 \cdot 3(Zn, Cu)(OH)_2$	1	
Azurite	$2CuCO_3 \cdot Cu(OH)_2$	1	
Beidellite	Similar to montmorillonite	1	
Beryl	$Be_3Al_2Si_6O_{18}$	6	6
Boehmite	AlO(OH)	1	6
Brushite (art.)	$HCaPO_4 \cdot 2H_2O$	1	
Carnotite	$K_2(UO_2)_2(VO_4)_2 \cdot 8H_2O$	1	
Cerite	(Ce, Y, Pr, Nd) $_2Si_2O_7 \cdot H_2O$	1	
Chlorite	(Mg, Fe) $_3Al_2Si_3O_{10}(OH)_8$ (var.)	2	8
Chloritoid	(Fe, Mg) $_2Al_4Si_2O_{10}(OH)_4$ (var.)	1	
Chrysoberyl	$BeAl_2O_4$	1	6
Collophanite	$3Ca_3P_2O_8 \cdot Ca[F_2, (OH)_2, CO_3]$	1	
Corundum	Al_2O_3	1	
Cryolite	Na_3AlF_6	1	6
Cyrtolite	Altered ZrSiO ₄	1	5, 6

<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
Danalite	$(\text{Fe}, \text{Mn}, \text{Zn})_4\text{Be}_3\text{Si}_3\text{O}_{12}\text{S}$	2	
Diaspore	HAlO_2	1	6
Dickinsonite	$\text{H}_2\text{Na}(\text{Mn}, \text{Fe})_{14}(\text{PO}_4)_{12} \cdot \text{H}_2\text{O}$	1	
Dumortierite	$\text{Al}_3\text{BSi}_3\text{O}_{19}(\text{OH})$	3	6
Fairfieldite	$\text{Ca}_2\text{MnF}_2\text{O}_8 \cdot 2\text{H}_2\text{O}$	2	
Fillowite	$3(\text{Mn}, \text{Fe}, \text{Na}_2)_3\text{P}_2\text{O}_8 \cdot \text{H}_2\text{O}$	1	
Fluorite	CaF_2	5	
Francolite	$3\text{Ca}_3\text{P}_2\text{O}_8 \cdot \text{Ca}[\text{F}_2, (\text{OH})_2, \text{CO}_3]$	1	6
Fuchsite	$\text{K}(\text{Al}, \text{Cr})_2\text{AlSi}_3\text{O}_{10}(\text{OH})_2$	2	
Gahnite	ZnAl_2O_4	1	
Garnet	$(\text{Mg}, \text{Fe}^{++}, \text{Mn}^{++}, \text{Ca})_3(\text{Al}, \text{Fe}^{+++}, \text{Cr}, \text{Ti}, \text{Mn}^{+++})_2(\text{SiO}_4)_3$	3	
Gearsutite	$\text{CaF}_2 \cdot \text{Al}(\text{F}, \text{OH})_3 \cdot \text{H}_2\text{O}$	1	
Gibbsite	$\text{Al}(\text{OH})_3$	1	6
Grunerite	$(\text{Mn}, \text{Fe}, \text{Mg})\text{Si}_5\text{O}_{22}(\text{OH})_2$	1	
Hambergite	$\text{Be}_2(\text{OH})\text{BO}_3$	1	
Helvite	$(\text{Mn}, \text{Fe}, \text{Zn})_4\text{Be}_3\text{Si}_3\text{O}_{12}\text{S}$	1	
Hemimorphite	$\text{Zn}_2\text{SiO}_3(\text{OH})_2$	4	6
Hulsite	$\text{Fe}_2^{++}\text{Fe}_2^{+++}\text{B}_2\text{O}_{10}$ with Mg and Sn	1	
Kaolinite	$\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$	1	5, 6
Malachite	$\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	1	
Montmorillonite	$(\text{Al}_2, \text{Mg}_3)\text{Si}_4\text{O}_{10}(\text{OH})_2 \cdot n\text{H}_2\text{O}$	3	6
Muscovite (sericite)	$\text{KAl}_3\text{Si}_3\text{O}_{10}(\text{OH})_2$	1	8
Opal	$\text{SiO}_2 \cdot n\text{H}_2\text{O}$	1	6
Paligorskite	Hydrous MgAl silicate	1	5
Parsettensite	$\text{Mn}_4\text{Si}_4\text{O}_{10}(\text{OH})_4 \cdot 3\text{H}_2\text{O}$	1	
Petalite	$\text{LiAlSi}_4\text{O}_{10}$	2	8
Pyroxmangite	$(\text{Mn}, \text{Fe})\text{SiO}_3$	1	
Quartz	SiO_2	1	6
Quartz (amethyst)	SiO_2	1	6
Rhodochrosite	MnCO_3	1	6
Rutile	TiO_2	1	6
Scapolite	$(\text{Na}, \text{Ca})_8\text{Al}_6(\text{Al}, \text{Si})_6\text{Si}_{12}\text{O}_{48}(\text{Cl}_2, \text{CO}_3)$	1	8
Scheelite	CaWO_4	1	6
Siderite	FeCO_3	2	5, 6
Sillimanite	Al_2SiO_5	3	
Smithsonite	ZnCO_3	1	
Spinel	MgAl_2O_4	1	
Staurolite	$\text{FeAl}_4\text{Si}_2\text{O}_{10}(\text{OH})_2$	1	5, 6
Stilbite	$(\text{Ca}, \text{Na}, \text{K})_3\text{Al}_5(\text{Al}, \text{Si})\text{Si}_{14}\text{O}_{40} \cdot 15\text{H}_2\text{O}$	1	8
Strontianite	SrCO_3	1	8
Thenardite	Na_2SO_4	1	
Thorianite	$(\text{Th}, \text{U})\text{O}_2$	1,	
Topaz	$\text{Al}_2\text{SiO}_4(\text{F}, \text{OH})_2$	2	6
Tourmaline	$(\text{Na}, \text{Ca})(\text{Mg}, \text{Fe}^{++}, \text{Fe}^{+++})_3\text{B}_3\text{Al}_3(\text{Al}_3\text{Si}_6\text{O}_{27})(\text{O}, \text{OH})_4$	5	8
Tripliodite	$(\text{Fe}, \text{Mn})\text{OH} \cdot (\text{Fe}, \text{Mn})\text{PO}_4$	1	

<i>pH</i>	<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
<i>pH 8</i>	Allanite	(Ca, Ce, La, Na) ₂ (Al, Fe, Mn, Be, Mg) ₃ (SiO ₄) ₃ OH	1	7
	Amblygonite	LiAl(F, OH)PO ₄	1	
	Anorthite	CaAl ₂ Si ₂ O ₈	1	
	Anthophyllite	(Mg, Fe) ₇ Si ₈ O ₂₂ (OH) ₂	5	9
	Apatite	Ca ₃ P ₂ O ₈ · Ca[F ₂ , Cl ₂ , (OH) ₂ , O, CO ₃ , SO ₄]	6	
	Aragonite	CaCO ₃	3	
	Bementite	Mn ₅ Si ₄ O ₁₀ (OH) ₆	1	9
	Benitoite	BaTiSi ₃ O ₉	1	
	Biotite	K(Mg, Fe) ₃ AlSi ₃ O ₁₀ (OH) ₂	3	9
	Calcite	CaCO ₃	16	
	Chlorite	(Mg, Fe) ₃ Al ₂ Si ₃ O ₁₀ (OH) ₈ (var.)	2	7
	Chondrodite	Mg ₆ (SiO ₄) ₂ (F, OH) ₂	1	10
	Cryophyllite	K ₂ Fe ²⁺ Li ₃ Al ₃ Si ₇ O ₂₀ (OH, F) ₄	1	
	Epidote	Ca ₂ (Al, Fe) ₃ Si ₃ O ₁₂ (OH)	5	
	Gillespite	BaFeSi ₄ O ₁₀	1	
	Hectorite	Li, Mg end-member montmorillonite	1	
	Heulandite	(Ca, Na, K) ₆ Al ₁₀ (Al, Si)Si ₂₉ O ₈₀ · 25H ₂ O	1	
	Hypersthene	(Fe, Mg)SiO ₃	1	
	Labradorite	Al ₅₀₋₃₀ Al ₁₅₀₋₇₀	2	9
	Larderellite	(NH ₄) ₂ B ₁₀ O ₁₆ · 5H ₂ O	1	
	Lawsonite	CaAl ₂ Si ₂ O ₇ (OH) ₂ · H ₂ O	1	
	Lepidolite	Lithium mica	5	9
	Lithiophyllite	Li(Mn, Fe)PO ₄	2	
	Ludwigite	Mg ₄ Fe ₂ B ₂ O ₁₀	1	
	Margarite	CaAl ₄ Si ₂ O ₁₀ (OH) ₂	3	9
	Microcline	KAlSi ₃ O ₈	4	9
	Muscovite	KAl ₃ Si ₃ O ₁₀ (OH) ₂	7	7
	Nahcolite	NaHCO ₃	1	
	Orthoclase	KAlSi ₃ O ₈	6	
	Petalite	LiAlSi ₄ O ₁₀	1	7
	Phillipsite	(Ca, Ba, K, Na) ₃ Al ₄ (Al, Si)Si ₅ O ₂₀ · 10H ₂ O	1	
	Pollucite	(Cs, Na, K) ₄ (Si, Al) ₁₃ O ₂₆ · H ₂ O	6	
	Rhodonite	MnSiO ₃	3	
	Roscoelite	KV ₂ AlSi ₃ O ₁₀ (OH) ₂ (var.)	1	
	Scapolite	(Na, Ca) ₈ Al ₆ (Al, Si) ₆ Si ₁₂ O ₄₈ (Cl ₂ , CO ₃)	3	7
	Scolecite	CaAl ₂ Si ₃ O ₁₀ · 3H ₂ O	1	
	Sepiolite	Mg ₂ Si ₃ O ₆ (OH) ₄	1	
	Serpentine (ferruginous)	(Mg, Fe) ₃ Si ₂ O ₅ (OH) ₄	1	10
	Spodumene	LiAlSi ₂ O ₆	2	
	Stilbite	(Ca, Na, K) ₃ Al ₅ (Al, Si)Si ₁₄ O ₄₀ · 15H ₂ O	2	7
	Strontianite	SrCO ₃	1	7
	Tourmaline	(Na, Ca)(Mg, Fe ²⁺ , Fe ³⁺) ₃ B ₃ Al ₃ (Al ₃ Si ₆ O ₂₇)(O, OH) ₄	1	7
	Vermiculite	(Mg, Fe) ₃ (Al, Fe)AlSi ₃ O ₁₀ (OH) ₄ · 4H ₂ O	1	9
	Witherite	BaCO ₃	1	

	<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
	Zincite	ZnO	1	
	Zinnwaldite	KLiMgAl ₂ Si ₃ O ₁₀ (OH, F) ₂	3	
<i>pH 9</i>	Aegirite	(Ca, Na)(Mg, Fe, Al)Si ₂ O ₆	3	
	Albite	NaAlSi ₃ O ₈	1	10
	Albite (peristerite)	Ditto	1	
	Alleghenyite	Mn ₅ (SiO ₄) ₂ (OH, F) ₂	1	
	Anthophyllite	(Mg, Fe) ₇ Si ₈ O ₂₂ (OH) ₂	4	8
	Bavenite	Ca ₄ BeAl ₂ Si ₉ O ₂₅ (OH) ₂	1	
	Bementite	Mn ₅ Si ₄ O ₁₀ (OH) ₆	3	8
	Biotite	K(Mg, Fe) ₃ AlSi ₃ O ₁₀ (OH) ₂	1	8
	Chabazite	(Ca, Na, K) ₇ Al ₁₂ (Al, Si) ₂ Si ₂₆ O ₈₀ · 40H ₂ O	1	
	Chlorite (sheridanite)	Mg ₅ Al ₂ Si ₃ O ₁₀ (OH) ₈	1	
	Clinochlore	(Mg, Fe) ₅ Al ₂ Si ₃ O ₁₀ (OH) ₈	2	
	Colemanite	Ca ₂ B ₆ O ₁₁ · 5H ₂ O	1	10
	Danburite	CaB ₂ Si ₂ O ₈	1	
	Deweylite	4MgO · 3SiO ₂ · 6H ₂ O	1	
	Dolomite	CaMg(CO ₃) ₂	1	10
	Idocrase	Ca ₁₀ Al ₄ (Mg, Fe) ₂ Si ₉ O ₃₄ (OH) ₄	3	10
	Imerinite	Sodium amphibole	1	
	Inyoite	2CaO · 3B ₂ O ₃ · 13H ₂ O	1	
	Kotschubeite	(Mg, Fe) ₅ Al ₂ Si ₃ O ₁₀ (OH) ₈	1	
	Labradorite	Ab ₅₀₋₃₀ An ₅₀₋₇₀	2	8
	Lepidolite	Lithium mica	3	8
	Margarite	CaAl ₄ Si ₂ O ₁₀ (OH) ₂	1	8
	Microcline	KAlSi ₃ O ₈	4	8
	Oligoclase	Ab ₉₀₋₇₀ An ₁₀₋₃₀	3	
	Polyolithionite	KLi ₂ AlSi ₄ O ₁₀ F ₂	1	
	Serendibite	CaMg ₂ Al ₃ BSi ₂ O ₁₃	1	
	Sphene	CaTiSiO ₅	3	
	Talc	Mg ₃ Si ₄ O ₁₀ (OH) ₂	5	
	Ulexite	NaCaB ₅ O ₉ · 8H ₂ O	2	10
	Vermiculite	(Mg, Fe) ₃ (Al, Fe)AlSi ₃ O ₁₀ (OH) ₄ · 4H ₂ O	1	8
	Xanthophyllite (walueite)	CaMg ₂ Al ₄ SiO ₁₀ (OH) ₂	1	
	Zoisite	Ca ₂ Al ₃ Si ₃ O ₁₂ (OH)	8	
<i>pH 10</i>	Albite	NaAlSi ₃ O ₈	2	9
	Amphibole	(Mg, Fe, Ca, Al) ₇ (Si, Al) ₈ O ₂₂ (OH, F) ₂	1	
	Augite	Ca(Mg, Fe, Al)(Al, Si) ₂ O ₆	3	
	Borax	Na ₂ B ₄ O ₇ · 10H ₂ O	1	
	Chondrodite	Mg ₅ (SiO ₄) ₂ (F, OH) ₂	1	8
	Colemanite	Ca ₂ B ₆ O ₁₁ · 5H ₂ O	3	9
	Datolite	CaBSiO ₄ (OH)	3	11
	Diopside	CaMgSi ₂ O ₆	6	11
	Diopside (violane)	Ditto	1	
	Dolomite	CaMg(CO ₃) ₂	2	9

<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
Hornblende	$\text{Ca}_2\text{Na}(\text{Mg}, \text{Fe}^{++})_4(\text{Al}, \text{Fe}^{+++}, \text{Ti})_3$ $\text{Si}_6\text{O}_{22}(\text{O}, \text{OH})_2$	1	
Howlite	$\text{Ca}_2\text{Si}_3\text{O}_9(\text{OH})_5$	3	
Idocrase	$\text{Ca}_{10}\text{Al}_4(\text{Mg}, \text{Fe})_2\text{Si}_9\text{O}_{34}(\text{OH})_4$	4	9
Inesite	$\text{Mn}_7\text{Ca}_2\text{Si}_{10}\text{O}_{28}(\text{OH})_2 \cdot 5\text{H}_2\text{O}$	1	
Jeffersonite	$\text{Ca}(\text{Mg}, \text{Mn}, \text{Fe}, \text{Zn})\text{Si}_2\text{O}_6$	1	
Kernite	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$	1	
Leucite	$(\text{Ca}, \text{Na}, \text{K})(\text{Al}, \text{Si})_2\text{O}_6$	1	
Magnesite	MgCO_3	1	11
Monticellite	CaMgSiO_4	1	
Natrolite	$\text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$	3	
Nesquehonite	$\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$	1	
Olivine (chrysolite)	$(\text{Mg}, \text{Fe})_2\text{SiO}_4$	1	11
Pectolite	$\text{Ca}_2\text{NaSi}_3\text{O}_8(\text{OH})$	1	11
Phlogopite	$\text{KMg}_3\text{AlSi}_3\text{O}_{10}(\text{OH})_2$	5	11
Prehnite	$\text{Ca}_2\text{Al}_2\text{Si}_3\text{O}_{10}(\text{OH})_2$	2	
Pyroxene	$(\text{Ca}, \text{Mg}, \text{Fe}, \text{Mn}, \text{Zn})\text{SiO}_3$	1	
Roweite	$\text{H}_2(\text{Mn}, \text{Mg}, \text{Zn})\text{Ca}(\text{BO}_3)_2$	1	
Searlesite	$\text{NaB}(\text{SiO}_3)_2 \cdot \text{H}_2\text{O}$	1	
Serpentine	$\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$	2	8
Serpentine (picrolite)	Ditto	1	
Sodalite	$\text{Na}_4\text{Al}_3\text{Si}_3\text{O}_{12}\text{Cl}$	3	
Szaibelyite	$\text{Mg}_2\text{B}_2\text{O}_5 \cdot \text{H}_2\text{O}$	2	
Tremolite	$\text{Ca}_2\text{Mg}_5(\text{OH})_2(\text{Si}_4\text{O}_{11})_2$	1	11
Trona	$\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$	1	
Ulexite	$\text{NaCaB}_5\text{O}_9 \cdot 8\text{H}_2\text{O}$	2	9
Xonotlite	$\text{Ca}_3\text{Si}_3\text{O}_8(\text{OH})_2$	1	11
Zeophyllite	$\text{Ca}_8\text{Si}_6\text{O}_{15}(\text{OH}, \text{F})_{10}$	1	
pH 11 Actinolite	$\text{Ca}_2(\text{Mg}, \text{Fe})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$	4	
Apophyllite	$\text{KCa}_4\text{Si}_4\text{O}_{10}\text{F}_2 \cdot 8\text{H}_2\text{O}$	3	
Bakerite	$\text{Ca}_8\text{B}_{10}\text{Si}_6\text{O}_{35} \cdot 6\text{H}_2\text{O}$	1	
Brucite	$\text{Mg}(\text{OH})_2$	3	
Datolite	$\text{CaBSiO}_4(\text{OH})$	1	10
Diopside	$\text{CaMgSi}_2\text{O}_6$	1	10
Hanksite	$9\text{Na}_2\text{SO}_4 \cdot 2\text{Na}_2\text{CO}_3 \cdot \text{KCl}$	1	
Hillebrandite	$\text{Ca}_2\text{SiO}_8(\text{OH})_2$	1	
Magnesite	MgCO_3	3	10
Merwinite	$\text{Ca}_2\text{Mg}(\text{SiO}_4)_2$	1	
Olivine	$(\text{Mg}, \text{Fe})_2\text{SiO}_4$	5	10
Pectolite	$\text{Ca}_2\text{NaSi}_3\text{O}_8(\text{OH})$	2	10
Phlogopite	$\text{KMg}_3\text{AlSi}_3\text{O}_{10}(\text{OH})_2$	2	10
Roebblingite	$2\text{PbSO}_4 \cdot \text{Ca}_7\text{Si}_6\text{O}_{14}(\text{OH})_{10}$	1	
Spurrite	$2\text{Ca}_2\text{SiO}_4 \cdot \text{CaCO}_3$	1	
Thaumasite	$\text{CaSiO}_3 \cdot \text{CaCO}_3 \cdot \text{CaSO}_4 \cdot 15\text{H}_2\text{O}$	3	
Tremolite	$\text{Ca}_2\text{Mg}_5(\text{OH})_2(\text{Si}_4\text{O}_{11})_2$	5	10

<i>Mineral</i>	<i>Composition</i>	<i>Number of specimens</i>	<i>Other abrasion pH values</i>
Wollastonite	CaSiO_3	5	
Xonotlite	$\text{Ca}_3\text{Si}_3\text{O}_8(\text{OH})_2$	1	10
<i>pH 12</i> Gaylussite	$\text{CaCO}_3 \cdot \text{Na}_2\text{CO}_3 \cdot 5\text{H}_2\text{O}$	1	
Pirssonite	$\text{CaCO}_3 \cdot \text{Na}_2\text{CO}_3 \cdot 2\text{H}_2\text{O}$	1	
Shortite	$\text{Na}_2\text{Ca}_2(\text{CO}_3)_2$	1	

INDEX TO ABRASION pH OF SPECIES

	<i>Abrasion pH</i>		<i>Abrasion pH</i>
Actinolite	11	Betafite	6
Aegirite	9	Biotite	8, 9
Albite	9, 10	Bismutite	6
Allanite	7, 8	Bloedite	6
Alleghenyite	9	Blomstrandite	5
Alum	3	Boehmite	6, 7
Aluminite	4	Bolite	6
Alunite	6	Borax	10
Alunogen	2	Botryogen	3
Amazonstone (see microcline)	8, 9	Brookite	6
Amblygonite	8	Brucite	11
Amethyst (see quartz)	6, 7	Brushite	7
Amphibole	10		
Andalusite	7	Calamine (see hemimorphite)	6, 7
Anglesite	5	Calcite	8
Anhydrite	6	Carnallite	5
Annabergite	7	Carnotite	7
Anorthite	8	Cassiterite	6
Anthophyllite	8, 9	Celestite	5, 6
Apatite	8	Cerite	7
Apophyllite	11	Cerussite	6
Aragonite	8	Chabazite	9
Arseniosiderite	6	Chlorite	7, 8, 9
Augite	10	Chloritoid	7
Aurichalcite	7	Chondrodite	8, 10
Azurite	7	Chrysoberyl	6, 7
		Chrysocolla	6
Bakerite	11	Clinocllore	9
Barite	6	Colemanite	9, 10
Bastnaesite	6	Collophanite	7
Bavenite	9	Columbite	6
Beaverite	6	Copiapite	3
Beidellite	7	Coquimbite	1
Bementite	8, 9	Corundum	7
Benitoite	8	Cotunnite	5
Bentonite (see montmorillonite)	6	Cryolite	6, 7
Beryl	6, 7	Cryophyllite	8

	<i>Abrasion pH</i>		<i>Abrasion pH</i>
Cuprodestcloizite (see mottramite)	6	Hanksite	11
Cuprotungstite	6	Hectorite	8
Cyrtolite	5, 6, 7	Helvite	7
		Hematite	6
		Hemimorphite	6, 7
Danalite	7	Herderite	6
Danburite	9	Heulandite	8
Datolite	10, 11	Hillebrandite	11
Descloizite	6	Hinsdalite	6
Deweylite	9	Hornblende	10
Diadochite	5	Howlite	10
Diaspore	6, 7	Huebnerite	6
Dickinsonite	7	Hulsite	7
Dickite	6	Hureaulite	6
Diopside	10, 11	Hypersthene	8
Dolomite	9, 10		
Dumortierite	6, 7	Idocrase	9, 10
		Ilmenite	6
Eosphorite	6	Ilmenorutile	6
Epidote	8	Imerinite	9
Euxenite	6	Inesite	10
Evansite	5	Inyoite	9
Fairfieldite	7	Jarosite	5, 6
Fayalite	6	Jeffersonite	10
Fillowite	7		
Flajolotite	6	Kaolinite	5, 6, 7
Fluorite	7	Kernite	10
Francolite	6, 7	Kieserite	6
Fremontite	6	Kornelite	1
Fuchsite	7	Kotschubeite	9
		Kyanite	6
Gahnite	7		
Garnet	7	Labradorite	8, 9
Gaylussite	12	Langbeinite	6
Gearksutite	7	Lanthanite	6
Gibbsite	6, 7	Larderellite	8
Gillespite	8	Lawsonite	8
Glauberite	6	Lepidocrocite	6
Glauconite	5	Lepidolite	8, 9
Greenalite	6	Leucite	10
Grunerite	7	Lithiophyllite	8
Gypsum	6	Lucinite (see variscite)	6
		Ludwigite	8
Halite	6		
Halloysite	6	Magnesite	10, 11
Halotrichite	3	Malachite	7
Hambergite	7	Manganotantalite	6

	<i>Abrasion</i> <i>pH</i>		<i>Abrasion</i> <i>pH</i>
Margarite	8, 9	Pyroxene	10
Meerschaum (see Sepiolite)	8	Pyroxmangite	7
Melanterite	2, 3		
Merwinite	11	Quartz	6, 7
Microcline	8, 9		
Minervite	5	Racewinite (see beidellite)	7
Mirabilite	6	Rectorite	5
Monazite	5, 6	Redingtonite	3
Monticellite	10	Reddingite	6
Montmorillonite	6, 7	Rhagite	5
Mottramite	6	Rhodochrosite	6, 7
Muscovite	7, 8	Rhodonite	8
		Rhombochase	1
Nahcolite	8	Roebbingite	11
Natrolite	10	Roscoelite	8
Nesquehonite	10	Roweite	10
Nitre	6	Rutile	6, 7
Nitrocalcite	6		
Nontronite	5, 6	Salammoniac	6
		Samarskite	6
Oligoclase	9	Sassolite	5
Olivine	10, 11	Scapolite	7, 8
Olivenite	6	Scheelite	6, 7
Opal	6, 7	Scolecite	8
Orthoclase	8	Scorodite	5
		Searlesite	10
Palacheite (see botryogen)	3	Sepiolite	8
Paligorskite	5, 7	Serendibite	9
Parsettensite	7	Sericite (see muscovite)	7
Pectolite	10, 11	Serpentine (ferruginous)	8
Petalite	7, 8	Serpentine	10
Phillipsite	8	Sheridanite (see chlorite)	9
Phlogopite	10, 11	Shortite	12
Pickeringite	3	Siderite	5, 6, 7
Picrolite (see serpentine)	10	Sillimanite	7
Pinite	6	Smithsonite	7
Pirssonite	12	Sodalite	10
Pitchblende (see Uraninite)	5, 6	Soda nitre	6
Planchéite	6	Spencerite	5
Plumbojarosite	5	Sphalerite	5, 6
Pollucite	8	Sphene	9
Polyhalite	5, 6	Spinel	7
Polythionite	9	Spodumene	8
Prehnite	10	Spurrite	11
Pseudoboléite	5	Staurolite	5, 6, 7
Pseudowavellite	5	Stibiotantalite	5
Pyrophyllite	6	Stilbite	7, 8

	<i>Abrasion pH</i>		<i>Abrasion pH</i>
Strontianite	7, 8	Vanadinite	5, 6
Sulfur	6	Vanoxite	3
Sylvite	6	Vanthoffite	6
Szaibelyite	10	Variscite	5, 6
Talc	9	Vegasite (see plumbojarosite)	5
Tantalite	6	Vermiculite	8, 9
Thaumasite	11	Vesuvianite (see idocrase)	9, 10
Thenardite	7	Violane (see diopside)	10
Thorianite	7	Vivianite	5
Titanite (see sphene)	9	Walueite (see xanthophyllite)	9
Thorotungstite	6	Wavellite	5
Topaz	6, 7	Witherite	8
Torbernite	6	Wolframite	6
Tourmaline	7, 8	Wollastonite	11
Tremolite	10, 11	Wulfenite	6
Triplite	6		
Triploidite	7	Xanthophyllite	9
Trona	10	Xonotlite	10, 11
Tschemmigite	3		
Tungstite	6	Zeophyllite	10
Turquoise	4, 6	Zincite	8
		Zinnwaldite	8
Ulexite	9, 10	Zircon	6
Uraninite (pitchblende)	5, 6	Zoisite	9