

GEMS PROPERTY CHART

	Gem		R.I.			Color								Transp	Phenom	Other Visual Observations	Optic Ch. Crystal System	Pleo(2, 3)			Spectrum	Fracture Cleavage	Specific Gravity	UV Fluorescence	Hardness	Common Characteristics	Treatments	Gem Species	
			Com	Range	Bire	C	P	R	O	Y	G	B	V	B ₂	W	G	B ₁	W	M	S									
1	HEMATITE	O V E R T H E L I M I T	3.220-2.940		.280																					Carving marks on Intaglios, Frac. surface & streak commonly red-brown non to slightly attracted to magnet		HEMATITE	1
2	IMITATION HEMATITE (HEMATINE)																									Intaglios made by stamped, Frac. surface & streak commonly brownish to black attracted to magnet (commonly will be picked up), Trade name: Hematine		IMITATION HEMATITE (HEMATINE)	2
3	PYRITE																									Streak greenish to brownish black, commonly twin crystals Misnomer name: "marcasite" or "fool's gold"		PYRITE	3
4	CUPRITE		2.849	+0.01 -0.01																						Brownish red streak.		CUPRITE	4
5	SYN. MOISSANITE		2.691-2.648		.043																					Commonly near colorless with tint of green, yellow, brown, gray. Needle incl. often perpendicular to table facet, may have negative crystal.		SYN. MOISSANITE	5
6	SYN. RUTILE (Flame Fusion)		2.903-2.616		.287														2			**				Diamond simulant product commonly yellowish color, may contain gas bubbles, abraded facet junctions common.		SYN. RUTILE (Flame Fusion)	6
7	DIAMOND		2.417																							Sharp facet junctions, naturals with trigons, bearding, waxy to granular girdle surface no see-thru.	Fracture filling, HPHT, Laser drilling, Irradiation	DIAMOND	7
8	SYN. DIAMOND		same as natural																							Metallic flux incl, Growth pattern: cross-shapeed, square, or hourglass-shaped		SYN. DIAMOND	8
9	STRONTIUM TITANATE (Flame Fusion)		2.409																							Poor polish & abraded facet junctions common, may contain gas bubbles.		STRONTIUM TITANATE (Flame Fusion)	9
10	SPHALERITE ZINC BLENDE		2.369																							Color zoning common, may confused with spessartine, sphene and zircon fire may not seen due to low hardness.		SPHALERITE	10
11	LEAD GLASS Man-Made P.B.2.2	L I M I T	2.200																							Scratch on surface, may show gas bubbles		LEAD GLASS Man-Made P.B.2.2	11
12	CZ (Syn. Cubic Zirconia) Skull melt		2.150																							Commonly no inclusion, may have unmelted zirconium oxide powder and gas bubbles orange pavilion flash, slight see-thru.		CZ (Syn. Cubic Zirconia) Skull melt	12
13	CASSITERITE		2.093-1.997	+0.009 -0.006	.096- .098														2							Never orange, commonly drak brown to black, color zoning.		CASSITERITE	13
14	GGG (Gadolinium Gallium Garnet) Czochralski		1.970	+0.060																						Commonly no inclusion, may have gas bubbles, orange & blue pavilion flash, moderate see-thru.		GGG (Gadolinium Gallium Garnet) Czochralski	14
15	ZIRCON		1.984-1.925	+0.040 -0.145	.000- .059														2							Natural inclusions, abraded facet junctions. Low type Zircon (metamict) have weak or no doubling. Blue zircon almost always heat treated.	Heat treatment	ZIRCON	15
16	SCHEELITE		1.934-1.918	+0.003 -0.003	.016														2							Commonly strong blue in SWUV, syn. materials used only for industrial.		SCHEELITE	16
17	SPHENE TITANITE		2.034-1.900	+0.020 -0.020	.100- .135														2, 3							Natural inclusions, confused with zircon and demantoid.		SPHENE	17
18	ANDRADITE GARNET GROUP		1.888	+0.007 -0.033																						Horsetail like inclusion (curved, radiating needles), green variety well know as "Demantoid", confused with sphene and zircon.		ANDRADITE GARNET GROUP	18
19	YAG (Yttrium Aluminum Garnet) Czochralski		1.833	+0.010 -0.010																						Commonly no inclusion, may have gas bubbles, blue & violet pavilion flash, strong see-thru. Green YAG: red flash in transmitted light.		YAG (Yttrium Aluminum Garnet) Czochralski	19
20	SPESSARTINE GARNET GROUP		1.810	+0.004 -0.020																						2-ph liq incl. always has some orange, never show purple. Color & Spectrum are keys separate from almandine, The most well know orange garnet.		SPESSARTINE GARNET GROUP	20
21	GAHNITE	T O	1.800	+0.005 -0.010																						Appears almost black in reflected light.		GAHNITE	21
22	ALMANDINE GARNET GROUP		1.790	+0.030 -0.024																						Tradename "Rhodolite", if has purple color. Needle-like intersecting at 70° and 110°, crystals with halos, strong ADR		ALMANDINE GARNET GROUP	22
23	PAINITE		1.816-1.787		.029														2							For many years, less than 10 specimens were know to exist. Several thousand painite from Mogok today.		PAINITE	23
24	GROSSULAR-ANDRADITE GARNET GROUP		1.779-1.773																							Sometime sold as "Mali" or "Grandite" garnet in the trade.		GROSSULAR-ANDRADITE GARNET GROUP	24
25	CORUNDUM		1.770-1.762	+0.009 -0.005	.008- .010														2							Needle-like intersecting at 60° and 120°, crystals, fingerprint, straight or angular growth. Commercial treatments: Heat, Frac.Filled, diffusion, irradiation.	Heat treatment, Diffusion Fracture filling, Irradiation	CORUNDUM	25
26	SYN. CORUNDUM FLAME FUSION		same as natural																							Gas bubbles, curved striae (in red, orange, pink), curved color banding (in blue, violet, green, yellow), colorless often moderate whitish blue in SWUV.	Quench crackled and flux induced (to create fpt)	SYN. CORUNDUM FLAME FUSION	26
27	SYN. CORUNDUM FLUX		same as natural																							Flux incl.(often white, coarse, sticky looking maybe yellow), wispy veil, metallic incl. (often platinum), straight or angular growth.		SYN. CORUNDUM FLUX	27
28	SYN. CORUNDUM HYDROTHERMAL		same as natural																							Zigzag or undulating growth, nail like incl, liq, metallic incl.(often gold), straight or angular growth.		SYN. CORUNDUM HYDROTHERMAL	28
29	GAHNOSPINEL		1.760	+0.020 -0.020																						Mixture of gahnite and spinel; properties intermediate.		GAHNOSPINEL	29
30	PYROPE-ALMANDINE GARNET GROUP	T O	1.760	+0.005 -0.005																						Tradename "Rhodolite", if has purple color. Needle-like intersecting at 70° and 110°, crystals with halos, strong ADR		PYROPE-ALMANDINE GARNET GROUP	30
31	PYROPE-SPESSARTINE GARNET GROUP		1.760	+0.020 -0.010																						Sometime sold as "malaya" or "malaia" garnet in the trade. Needle-like intersecting at 70° and 110°, crystals with halos, strong ADR		PYROPE-SPESSARTINE GARNET GROUP	31
32	BENITOITE		1.804-1.757		.047														2							Blue & colorless pleochroism, often chalky blue in SWUV, no green color. Confused with sapphire		BENITOITE	32
33	CHRYSOBERYL		1.755-1.746	+0.004 -0.006	.008- .010														2, 3							Alexandrite (color-change) often strong pleochroism, good quality cat's eye may have "milk & honey", "open & closed eye" effect.	Irradiation	CHRYSOBERYL	33
34	SYN. CHRYSOBERYL FLUX, PULLED		same as natural may be slightly lower																							Flux: flux incl, wispy veil, metallic plates. Pulled: curved striae, gas bubbles.		SYN. CHRYSOBERYL FLUX, PULLED	34
35	PYROPE GARNET GROUP		1.746	+0.008 -0.016																						Tradename "Rhodolite", if has purple color. Needle-like intersecting at 70° and 110°, crystals with halos, strong ADR		PYROPE GARNET GROUP	35
36	GROSSULAR GARNET GROUP		1.740	+0.020 -0.010																						Hessonite: heat-wave effect, rounded crystals. Tsavorite and other colors: various natural inclusions. SWUV key to separate from syn. spinel.		GROSSULAR GARNET GROUP	36
37	AZURITE		1.838-1.730	+0.010 -0.010	.106														3							Effervesces to HCl, light blue streak, botryoidal sturcture. Often associated with malachite; called azurmalachite.		AZURITE	37
38	RHODONITE		1.747-1.733	+0.010 -0.013	.010- .014														2							Tp rare. Tl - O pink to red often veined with black manganese oxide. Spot R.I. often 1.73 may show 1.54 R.I. due to quartz impurities.		RHODONITE	38
39	EPIDOTE		1.768-1.729	+0.012 -0.035	.019- .045														3							May show pseudo-uniaxial optic figure, eye visible pleochroism common.		EPIDOTE	39

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		Com	Range	Bire	C	P	R	O	Y	G	B	V	Br	W	G	Bl	W	M	S									
40	SYN. SPINEL FLAME FUSION	1.728	+0.012 -.008					U	U											*** (blue) 540, 580, 635 bands	Con	same as natural	LW: non - st SW: non - st	8	Strong ADR (cross-hatch effect), gas bubbles, R.I., polariscope reaction, UV are keys to identify. Blue stone: red under Chelsea filter. Syn. Spinel triplet common.		SYN. SPINEL FLAME FUSION	40
41	SYN. SPINEL FLUX	1.719	+0.003 -.008																		Con	same as natural	LW: wk - st SW: wk - st	8	Usually incl. free, may be metallic flux, wispy veil, flux incl. Red, pink and blue are common color. Crystal shape similar to natural.		SYN. SPINEL FLUX	41
42	SPINEL	1.718	+0.017 -.008		U				U							U				*** depend on color	Con	3.60 +.10 -.10	LW: non - st SW: non - wk	8	Octahedral crystals (may be singly or in fingerprint pattern). Crystal habit often twin. Black stones usually high R.I.(1.76). Commonly same alluvium with corundum.		SPINEL	42
43	HYDROGROSSULAR GARNET (Aggregate)	1.720	+0.010 -.030																	** 460 line	Spl to Con	3.47 +.08 -.32	LW: non SW: non	7	Black incl. (peppery looking) common, RI key to separate from jadeite. Misnomer name: "african jade" or "transvaal jade".		HYDROGROSSULAR GARNET (Aggregate)	43
44	TAAFFEITE	1.723- 1.719	+0.002 -.002	.004- .009																	Con	3.61 +.01 -.01	LW: non - wk SW: non - wk	8- 8.5	Very rare gem, may confuse with spinel, RI, Birefringence and optic character key to separation.		TAAFFEITE	44
45	KYANITE	1.731- 1.716	+0.004 -.004	.012- .017																** 435, 445 bands	Step to Con CL: 1 per. 1 dist.	3.68 +.01 -.12	LW: non - wk SW: non - wk	4- 7.5	Commonly zoned, may appear fibrous, often blue and colorless pleochroism. Hardness 4 - 5 in one direction, 6 - 7.5 at right angle to it.		KYANITE	45
46	IDOCRASE VESUVIANITE	1.718- 1.713	+0.003 -.013	.001- .012								U								*** 464 line	Une to Con	3.40 +.10 -.15	LW: non SW: non	6.5	AGG: often 1.70 - 1.71 spot RI, misnomer name: "california jade" Tp: may show strain colors in polariscope.		IDOCRASE VESUVIANITE	46
47	CHLORASTROLITE PUMPELLYITE	1.722 1.702		.002- .022																	Spl to Gra	3.20 +.30 -.10	LW: non SW: non	5- 6	Mottled appearance resembling turtle shell or snakeskin, confused with malachite		CHLORASTROLITE PUMPELLYITE	47
48	WILLEMITE	1.719 1.691		.028																*** 421 band	Une to Con CL: 1 distinct	4.10 +.08 -.21	LW: mod - st SW: mod - st	5.5	Intense green in SWUV, may show phosphorescent. Absorption bands 583, 540, 490, 442 are fairly weak.		WILLEMITE	48
49	ZOISITE EPIDOTE GROUP	1.700- 1.691	+0.005 -.005	.008- .013																** depend on color	Step to Con CL: 1 perfect	3.35 +.10 -.25	LW: non SW: non	6- 7	Tanzanite: Tp blue to violite, RI & Pleo key to identification. Thulite: TI-O pink. Ruby in zoisite: TI-O green zoisite matrix with TI-O ruby.	Heat treatment, Coating	ZOISITE EPIDOTE GROUP	49
50	DUMORTIERITE	1.689- 1.678	+0.034 -.023	.011- .027																	Spl to Con CL: 1 distinct	3.30 +.11 -.09	LW: non - wk SW: non - wk	7- 8.5	Tp-Tl stones are strong pleo (rare), usually come as inclusion in quartz, know as dumortierite in quartz; RI 1.54-1.55		DUMORTIERITE	50
51	AXINITE	1.688- 1.678	+0.005 -.005	.010- .012					U			U									Une to Con CL: 1 distinct	3.29 +.07 -.11	LW: non - wk SW: non - wk	6.5- 7	Pleochroism key to separate from kornepurine, enstatite. Color often "rose brown", "clove brown".		AXINITE	51
52	DIOPSIDE	1.701- 1.675	+0.029 -.010	.024- .030	U							U	U							** 505 line common	Spl to Con CL: 2 perfect	3.29 +.11 -.07		5.5- 6.5	Tp green confused with peridot; RI birefringence and spectrum key to separation. Star: slight attracted to magnet (due to tapered ndl), Cat's eye: often dark green.		DIOPSIDE	52
53	SINHALITE	1.707- 1.668	+0.005 -.003	.036- .039				U												** 412, 465, 492 lines	Une to Con CL: 1 distinct	3.48 +.02 -.02	LW: non SW: non	6.5- 7	Confused with peridot; common RI and optic sign (sinhalite strongly negative) key to separation.		SINHALITE	53
54	KORNERUPINE	1.680- 1.667	+0.003 -.003	.013- .017	U															** weak 503 band	Spl to Con CL: 2 perfect	3.30 +.05 -.03	LW: non - mod SW: non - mod	6- 7	Strongly negative optic sign, commonly shows pseudo-uniaxial optic figure, confused with axinite, enstatite, and diopside		KORNERUPINE	54
55	SPODUMENE PYROXENE GROUP	1.676- 1.660	+0.005 -.005	.014- .016																** depend on color	Step to Con CL: 2 perfect	3.18 +.03 -.03	LW: non - st SW: weaker	6.5- 7	Most well known variety; Kunzite: mod to st pleochroism, often fluoresces. liquid inclusion, growth mark often triangle shape (sail shape).	Kunzite: Irradiation follow by heat	SPODUMENE PYROXENE GROUP	55
56	ENSTATITE PYROXENE GROUP	1.668- 1.658	+0.012 -.005	.008- .011	U															*** 505, 550 lines	Une to Con CL: 2 distinct	3.25 +.15 -.05	LW: non SW: non	5- 6	Confused with kornepurine, axinite; strongly 505, 550 lines spectrum, key to separation.		ENSTATITE PYROXENE GROUP	56
57	JADEITE PYROXENE GROUP	1.680- 1.660	+0.008 -.008	.020																** 437 line	Spl to Gra	3.34 +.06 -.09	LW: non - st SW: non - st	6.5- 7	Confused with nephrite, idocrase, hydrogrossular, and others; RI, SG and spectrum key to separation. Dyed green has 640-670 band in spectrum. Spot RI 1.66	Dyed, Bleaching, Impregnation	JADEITE PYROXENE GROUP	57
58	JET	1.660	+0.020 -.020																		Spl to Con Lus: DI to Gre	1.32 +.02 -.02	LW: non SW: non	2.5- 4	Ornamental form of lignite coal; brown streak		JET	58
59	SILLIMANITE FIBROLITE	1.680- 1.659	+0.004 -.006	.015- .021																	Spl to Con CL: 1 perfect	3.25 +.02 -.11		6- 7.5	Commonly fibrous, sharp cat's eye, Tp material rare		SILLIMANITE FIBROLITE	59
60	DIOPTASE	1.708- 1.655	+0.012 -.012	.051- .052																** 550 broad band	Step to Con CL: 3 perfect	3.30 +.05 -.05	LW: non SW: non	5	Commonly twin crystals, color similar to fine emerald but slightly more blue.		DIOPTASE	60
61	MALACHITE	1.909- 1.655		.254																	Spl to Une	3.95 +.15 -.70	LW: non SW: non	3.5- 4	Curved or angular banding, effervesces to HCl, green streak, botryoidal structure. Often associated with Azurite; called azurmalachite.		MALACHITE	61
62	PERIDOT OLIVINE GROUP	1.690- 1.654	+0.020 -.020	.035- .038																** 457, 477, 497 lines	Con	3.34 +.14 -.07	LW: non SW: non	6.5- 7	Disk-like inclusion "lilypad", dark octahedral chromite crystals, moderate doubling confused with diopside and sinhalite.		PERIDOT OLIVINE GROUP	62
63	PHENAKITE	1.670- 1.654	+0.026 -.004	.016				U		U		U	U								Con	2.95 +.05 -.05	LW: non - wk SW: non - wk	7.5- 8	Confused with spodumene and euclase: optic character key to separation.		PHENAKITE	63
64	EUCLASE	1.671- 1.652	+0.006 -.002	.019- .020																	Step to Con CL: 1 perfect	3.08 +.04 -.08	LW: non - wk SW: non - wk	7.5	Red or blue plate inclusions, may be color zoned, confused with spodumene and phenakite.		EUCLASE	64
65	JEREMEJEVITE	1.651- 1.640	+0.002 -.001	.007- .013																	Con	3.27 +.04 SW: non	LW: non SW: non	6.5- 7.5	Hollow tubes, natural inclusions. One of the most expensive and rare stone.		JEREMEJEVITE	65
66	BARITE	1.648- 1.636	+0.001 -.002	.012																	Step to Con CL: 2 perfect	4.50 +.10 -.20	LW: non - mod SW: non - mod	3- 3.5	Commonly fluoresces/phosphoresces light blue to green, white massive material look like marble calcite.		BARITE	66
67	SYN. FORSTERITE PULLED	1.670- 1.634		.033- .038																** 460 band	Con	3.23 +.01 -.01	LW: non - wk SW: non - wk	7	Gas bubbles, minute particles, tiny needles. Strong blue and purplish pink pleochroic.		SYN. FORSTERITE PULLED	67
68	ANDALUSITE	1.643- 1.634	+0.005 -.005	.007- .013																	Une to S-Con CL: 1 distinct	3.17 +.04 -.04	LW: non SW: non - mod	7- 7.5	Rutile needles, natural inclusions. Variety Chiastolite: TI-O with dark, cross pattern on gray to brown massive material.		ANDALUSITE	68

TERMS AND ABBREVIATIONS

GEM

Black color name = common in market
Brown color name = not common in market (collector gem)
Red color name = man-made material

R.I. = Refractive Index

Com = most common R.I.
Bire = birefringence

Transp = Transparency

Tp = transparent
S-Tp = semitransparent
TI = translucent
S-TI = semitranslucent
O = opaque

COLOR

— (Horizontal line) = common color
Ad = uncommon color
Half box = secondary (modifying) color

C = colorless
P = purple
R = red
O = orange
Y = yellow
G = green
B = blue
V = violet
Br = brown
W = white
Gr = gray
Bl = black

Phenom = Phenomena

A = asterism
Ad = adularescence
Av = aventurescence
C = chatoyancy
CC = color-change
I = iridescence
L = labradorescence
O = orient
P = play-of-color

Other Visual observations

Ex = extreme
St = strong
Mod = moderate
Wk = weak
Disp. = dispersion

Optic Ch. = Optic character

DR = doubly refractive
SR = singly refractive
ADR = anomalous double refraction
AGG = aggregate
U = uniaxial
B = biaxial
+ = positive
- = negative

Pleo. = Pleochroism

2 = 2 colors (dichroism)
3 = 3 colors (trichroism)
S = strong
M = moderate
W = weak

Spectrum (nanometer)

*** = usually found
** = less often found
(blank) = sometimes found
or none found

Fracture/Cleavage

Con = conchoidal
Gra = granular
Spl = splintery
Step = step-like
Une = uneven
CL = cleavage
Dist. = distinct
Dir. = direction
Per. = perfect

UV = Ultraviolet Fluorescence

LW = long-wave ultraviolet
SW = short-wave ultraviolet
St = strong reaction
Mod = moderate reaction
Wk = weak reaction
Non = no reaction (inert)

Common Characteristics

Frac. = fracture
HCl = hydrochloric acid
Incl. = inclusion
Liq. = liquid
Nat. = natural
see-thru = see-through effect
SG = specific gravity
Syn. = synthetic

	Gem	R.I.			Color										Transp	Phenom	Other Visual Observations	Optic Ch. Crystal System	Pleo(2, 3)			Spectrum	Fracture Cleavage	Specific Gravity		UV Fluorescence		Hardness	Common Characteristics	Treatments	Gem Species	
		Com	Range	Bire	C	P	R	O	Y	G	B	V	B+	W					G	B-	W			M	S	W	M				S	LW: non - wk SW: non - wk
69	APATITE	1 7 0	1.638-1.634	+.012-.006	.002-.008													2			***	Une to Con	3.18 +.05 -.05	LW: non - wk SW: non - wk	5	580 nm doublet lines common in colorless, yellow and cat's eye stones, may show pseudo-biaxial optic figure, confused with tourmaline, topaz, danburite and lazulite	Heat treatment	APATITE	69			
70	DANBURITE		1.636-1.630	+.003-.003	.006													2			depend on color	Une to Con	3.00 +.03 -.03	LW: non - st SW: weaker	7	Often fluoresces light blue, confused with topaz, apatite		DANBURITE	70			
71	DATOLITE		1.670-1.626	+.004-.004	.046																Une to Con	2.95 +.05 -.05	SW: non - mod	5-5.5	Transparent crystals (light geen, nearly colorless), rarely cut.		DATOLITE	71				
72	TOURMALINE TOURMALINE GROUP		1.644-1.624	+.011-.009	.018-.040														2		**	depend on color	Con	3.06 +.20 -.06	LW: non - wk SW: non - wk	7-7.5	Thread-like liquid and gas inclusions, mirror-like gas-filled fractures, birefringence commonly .020 (may be .040 in very dark stones).	Heat teatment, Irradiation	TOURMALINE TOURMALINE GROUP	72		
73	SMITHSONITE		1.849-1.621		.228																		4-5	LW: non - st SW: non - st	5	May be botryoidal and massive, effervesces to HCl		SMITHSONITE	73			
74	TOPAZ		1.627-1.619	+.010-.010	.008-.010														2, 3		**	depend on color	Step to Con CL: 1 perfect	3.53 +.04 -.04	LW: non - wk SW: non - mod	8	Two or more nonmiscible liquid inclusions, basal cleavage. Colorless, blue (RI 1.609 - 1.617), others (RI 1.629 - 1.637).	Heat teatment, Irradiation Coating, Diffusion	TOPAZ	74		
75	PREHNITE		1.649-1.616	+.016-.005	.020-.033																**	weak 438 band	Une to Con Cl: 1 distinct	2.90 +.05 -.10	LW: non - wk SW: non - wk	6-6.5	Often botryoidal, usually AGG reaction in polariscope, confused with nephrite, jadeite. Spot RI 1.63		PREHNITE	75		
76	ACTINOLITE AMPHIBOLE GROUP		1.641-1.614	+.014-.027	.022-.027																	Step to Une CL: 2 perfect	3.00 +.10 -.05		5-6	Cat's eye; fibrous structure, "milk and honey" effect, often misrepresented as "cat's eye jade". Tp stones rare. Spot RI 1.63		ACTINOLITE AMPHIBOLE GROUP	76			
77	HEMIMORPHITE		1.636-1.614	+.003-.003	.022																	Step to S-Con CL: 2 perfect	3.45 +.05 -.05		4.5-5	May be banded, confused with smithsonite.		HEMIMORPHITE	77			
78	LAZULITE		1.643-1.612	+.005-.005	.031-.036														2, 3			Gra to Con	3.09 +.08 -.01		5-6	Tp gems strong pleochroic; dark blue, light blue, colorless, confused with tourmaline Massive stones mottled with white, confused with lapis lazuli.		LAZULITE	78			
79	AMBLYGONITE	1 . 6 0	1.636-1.612		.020-.027													2			Step to Con CL: 1 perfect	3.02 +.04 -.04	LW: non - wk SW: non - wk	5.5-6	Montebrasite series with Amblygonite common RI 1.612-1.636. Amblygonite series with Montebrasite common RI 1.585-1.605.		AMBLYGONITE	79				
80	BRAZILIANITE		1.621-1.602	+.003-.003	.019-.021													2			Step to Con CL: 1 perfect	2.97 +.03 -.03	LW: non SW: non	5.5	Confused with amblygonite, more green than amblygonite.		BRAZILIANITE	80				
81	PEZZOTTAITE		1.617-1.608	+.010	.008-.009													2			Une to Con	3.10 +.04 -.06	LW: non SW: non	7.5-8	Liquid inclusion, growth tube. Might be sold as "hot pink red beryl", "red beryl", "raspberyl" or malagasite in the trade.		PEZZOTTAITE	81				
82	TURQUOISE		1.650-1.610																	**	420, 432 bands	Gra to Con Lus: DI to Wx	2.76 +.14 -.36	LW: non - wk SW: non	5-6	Black, brown, white or metallic(pyrite) matrix. Spot RI 1.61	Zachery, Impregnation, Dyed	TURQUOISE	82			
83	IMITATION TURQUOISE GILSON		1.620-1.600																				2.75 -.15		5-6	"cream-of-wheat" under reflected light, may have "artificial spiderweb matrix"		IMITATION TURQUOISE GILSON	83			
84	SUGILITE		1.610-1.607	+.001-.002																		Gra	2.74 +.05 SW: non	LW: non SW: non	5.5-6.5	Usually occurs as aggregates; know in the trade as "Royal Lavulite" or "Royal Azel". may show RI 1.54 due to quartz, confused with charoite		SUGILITE	84			
85	NEPHRITE AMPHIBOLE GROUP		1.632-1.606	+.009-.006																		Spl to Gra	2.95 +.15 -.05	LW: non SW: non	6-6.5	Black inclusions common, usually low saturation color. Spot RI 1.61.	May be dyed	NEPHRITE AMPHIBOLE GROUP	85			
86	PECTOLITE		1.628-1.599	+.017-.004	.029-.038																	Spl to Une CL: 2 perfect	2.81 +.09 -.07	LW: non - mod SW: non - mod	4.5-5	Radial fibrous structure, mottled with white, may phosphoresce. Confused with turquoise, trade name "Larimar". Spot RI 1.60		PECTOLITE	86			
87	RHODOCHROSITE		1.817-1.597	+.003-.003	.201-.220														2		**	Step to Une CL: 3 perfect	3.60 +.10 -.15	LW: non - mod SW: non - mod	3.5-4.5	TI-O; "bacon-strip" common. TP; rare. Confused with rhodonite. Effervesces to HCl.		RHODOCHROSITE	87			
88	HOWLITE		1.605-1.586	+.003-.003																		Gra	2.58 +.01 -.13	LW: non - mod SW: non - mod	3.5	Untreated color is white, may be spiderweb matrix. Dyed blue confused with turquoise. Effervesces to HCl. May be pinkish through Chelsea filter. Spot RI 1.59	Dyed, Impregnation	HOWLITE	88			
89	CHRYSOCOLLA	1 . 6 0	1.598-1.575																		Une to Con	2.20 +.25 -.25		2-4	Often occurred as inclusions in chalcedony. Usually more translucent than turquoise. Eilat stone: rock composed of chrysocola, turquoise and malachite; SG 3.00 ± 0.20.		CHRYSOCOLLA	89				
90	BERYL		1.583-1.577	+.017-.017	.005-.009														2		**	Une to Con	2.72 +.18 -.05	LW: non - st SW: non - st	7.5-8	Properties vary with variety. Emerald: 3-phase, 2-phase incl., fingerprint, biotite mica calcite, pyrite crystals. Others: 2-phase, tubular incl.	Emerald: Fracture Filled Others: Heat, Irradiation	BERYL	90			
91	SYN. EMERALD (SYN. BERYL) HYDROTHERMAL		1.573-1.568	+.008-.003	.005-.007																	Con	2.68 +.03 -.03	LW: non - st SW: non - st	7.5-8	Zigzag "chevron" growth, cone-shape spaces "nailhead spicules", wispy incl., wavy fingerprint, syn. phenakite crystal, uniform parallel growth.		SYN. EMERALD (SYN. BERYL) HYDROTHERMAL	91			
92	SYN. EMERALD (SYN. BERYL) FLUX		1.564-1.561	+.010	.003-.008																	Con	2.66 +.03 -.01	LW: non - st SW: non - mod	7.5-8	Flux incl.: coarse (often white & high relief), wispy veil, platinum, syn. phenakite crystals, uniform parallel growth.		SYN. EMERALD (SYN. BERYL) FLUX	92			
93	VARISCITE		1.590-1.560	+.003-.006																		Une	2.50 +.10 -.30	LW: non - wk SW: non - wk	3.5-5	Grayish yellow to brown matrix. Pinkish through chelsea filter. Confused with turquoise. Spot RI 1.57		VARISCITE	93			
94	SERPENTINE		1.570-1.560	+.004-.015																		Gra to Une	2.57 +.23 -.13	LW: non - wk SW: non - wk	2-6	Black, moss-like inclusion, white veining; often poor polish. Confused with jadeite, nephrite, chalcedony. Variety bowenite hardness 5-6.		SERPENTINE	94			
95	CORAL CONCHIOLIN		1.57-1.56	+.01-.01																		Une to Con	1.35 +.77 -.05	LW: non SW: non	3-3.5	Dimpled surface, translucent brown in thin section. Black coral may be bleached to a golden coral, often show coarse texture. Untreated golden : may have faint sheen	Bleaching, Dyed	CORAL CONCHIOLIN	95			
96	LABRADORITE FELDSPAR GROUP		1.568-1.559	+.005-.005	.009														2, 3			Step to Con CL: 1 per. 1 dist.	2.70 +.05 -.05	LW: non - wk SW: non - wk	6-6.5	Repeated twinning, black short needles, plates common in labradorescent material. Sunstone: red to orange platelets. TP nonphenomenal confused with beryl, scapolite.	Heat treatment	LABRADORITE FELDSPAR GROUP	96			
97	BERYLLONITE		1.562-1.552		.009-.010														2			Step to Con CL: 1 per. 1 dist.	2.82 +.05 -.03	LW: non SW: non	5.5-6	Pseudo-orthorhombic crystal. Confused with beryl, labradorite, quartz, scapolite. optic character, optic sign key to separation.		BERYLLONITE	97			
98	SCAPOLITE		1.564-1.550	+.015-.014	.004-.037														2			Step to Con CL: 2 perfect	2.68 +.10 -.14	LW: non - st SW: non - st	6-6.5	Colorless and yellow stones often fluoresce orange to pink. Confused with quartz, beryl, labradorite.		SCAPOLITE	98			
99	CHAROITE	1 . 5 0	1.559-1.550	+.002-.002	.009																Spl to Gra	2.68 +.10 -.14	LW: non - wk SW: non - wk	5-6	Violet to purplish violet rock with swirl fibrous appearance, may be sheen.		CHAROITE	99				
100	IMITATION CORAL GILSON		1.550																			Gra	2.44		3.5-4	No structure lines of natural coral, granuler texture, no birefringence blink.		IMITATION CORAL GILSON	100			
101	TORTOISE SHELL		1.550		.010																	Spl to Une	1.29 +.06 -.03	LW: non - st SW: non - st	2.5	Dark minute particles seen in magnification. Confused with plastic.		TORTOISE SHELL	101			
102	QUARTZ Crystalline and Microcrystalline		1.553-1.544		.009														2		**	Spl to Con	2.66 +.03 -.02	LW: non - wk SW: non - wk	7	Color zoning, liquid, 2-phase inclusion, "zebra-stripe". May be bull's eye optic figure, may show Brazil-law twinning.	Heat treatment, Irradiation Dyed, Coating	QUARTZ Crystalline and Microcrystalline	102			
103	SYN. QUARTZ HYDROTHERMAL		same as natural																			Con	same as natural	LW: non - wk SW: non - wk	7	Breadcrumb-like, zigzag "chevron" growth, cone-shape spaces "nailhead spicule".		SYN. QUARTZ HYDROTHERMAL	103			
104	IOLITE CORDIERITE		1.551-1.542	+.045-.011	.008-.012														2, 3			Une to Con Cl: 1 distinct	2.61 +.05 -.05	LW: non SW: non	7-7.5	Plate-like fingerprint. Confused with amethyst, scapolite pleo. key to separation. "bloodshot iolite": aventurescent iolite containing red hematite platelets.		IOLITE CORDIERITE	104			
105	IVORY ELEPHANT		1.540		.005																	Spl	1.85 +.15 -.15	LW: wk - st SW: wk - st	2.5	Confused with other animal ivories, bone, vegetable ivories. Usually chalky blue in LWUV. Effervesces to HCl.	Bleaching, Dyed	IVORY ELEPHANT	105			
106	AMBER		1.540	+.005-.001																		Con	1.08 +.02 -.08	LW: non - st SW: weaker	2-2.5	Strong ADR, gas bubbles, flow lines, insects, organic inclusion. Float						

	Gem	R.I.			Color										Transp	Phenom	Other Visual Observations	Optic Ch. Crystal System	Pleo(2, 3)			Spectrum	Fracture Cleavage	Specific Gravity		UV Fluorescence	Hardness	Common Characteristics	Treatments	Gem Species	
		Com	Range	Bire	C	P	R	O	Y	G	B	V	B _r	W					G _i	Bl	W			M	S						
109	APOPHYLLITE		1.537-1.535	+0.01-0.003																						Commonly shows strain colors in polariscope. May show pseudo-biaxial optic figure. Confused with quartz, scapolite.		APOPHYLLITE	109		
110	PEARL Natural and cultured		1.685-1.530		.155																					Gritty to teeth (most imitation smooth), suture line on surface (high magnification), effervesces to HCl. Key separate Nat.vs Cultured: X-radiography, X-ray fluorescence	Bleaching, Dyed, Irradiation Heat treatment, Coating	PEARL Natural and cultured	110		
111	SHELL		1.685-1.530		.155																					Cameo: irregular fibrous, concave back. Mother of pearl: shell with orient, confused with pearl. Operculum: spiral growth on base. Effervesces to HCl.	Dyed	SHELL	111		
112	ARAGONITE		1.685-1.530		.155																					May phosphoresce, effervesces to HCl. A polymorph of calcite.		ARAGONITE	112		
113	AMMONITE KORITE	1	1.675-1.520		.155																					Fossilized shell of an extinct nautilus-like animal, may be spiral, mosaic patterns. Ammonite triplet; often used syn.spinel top. Key tests are appearance.		AMMONITE KORITE	113		
114	MAW-SIT-SIT	6	1.540-1.520																							Rock composed of ureyite with varying combinations of amphibole, feldspar groups. RI varies due to different minerals present, most commonly is 1.53.		MAW-SIT-SIT	114		
115	MICROCLINE FELDSPAR GROUP		1.530-1.522	+0.004-0.004	.008																					Amazonite: only common gem variety. Grid-like intergrowth of blue-green microcline and white albite. Confused with turquoise, chalcedony.		MICROCLINE FELDSPAR GROUP	115		
116	ORTHOCLASE FELDSPAR GROUP		1.526-1.518	+0.010-0.010	.005-0.008													2		**						Moonstone: adularescence, centipede-like inclusions, confused with chalcedony Sanidine: transparent yellow, confused with citrine.		ORTHOCLASE FELDSPAR GROUP	116		
117	UNAKITE	T	1.55, 1.52	maybe 1.74																						Rock composed of green epidote, white to gray quartz and pink feldspar. RI varies due to different minerals present.		UNAKITE	117		
118	POLLUCITE	O	1.520	+0.005-0.003																						Strong ADR common, may show strain colors. Offten fluoresces orange to pink.		POLLUCITE	118		
119	THOMSONITE		1.540-1.515	+0.015-0.018																						Banded or mottled in pink and white with brown, yellow. Confused with agate. Spot RI 1.52. Tradename "eye stone".		THOMSONITE	119		
120	MAGNESITE	1	1.700-1.509		.191																					May be spiderweb matrix. Dyed blue confused with turquoise, dyed howlite Effervesces to HCl. Birefringence blink key to separation. May be phosphorescence.	Dyed, Impregnation	MAGNESITE	120		
121	LEUCITE	5	1.509-1.508	+0.003-0.004	.000-0.001																					Very weak birefringence, may confused with SR. Often euhedral pseudocubic crystal. Crystals may show yellow or brown stains on surface.		LEUCITE	121		
122	PETALITE	0	1.516-1.504	+0.007-0.002	.012-0.016																					Some materials may show an orange fluorescence.		PETALITE	122		
123	LAPIS LAZULI		1.670, 1.500																							Rock composed of blue lazurite, white calcite and yellow metallic pyrite. Effervesces to HCl. Dyed: detected with acetone.	Dyed, Impregnation	LAPIS LAZULI	123		
124	IMITATION LAPIS LAZULI GILSON		1.550-1.500																							Generally no calcite and very little pyrite, pyrite small grains and evenly distributed. Almost always lower SG than lapis lazuli.		IMITATION LAPIS LAZULI GILSON	124		
125	ULEXITE		1.519-1.496		.023																					Massive form of parallel fibrous, placing the direction of fibers at right angles to a page of print they will carry a fiber-optic image of print.		ULEXITE	125		
126	TUGTUPITE		1.502-1.496		.006-0.008																					Show an attractive fluorescence with the red response to UV, may phosphoresce.		TUGTUPITE	126		
127	OBSIDIAN NATURAL GLASS (Volcanic)		1.490	+0.020-0.010																						Gas bubbles, black stubby needle or crystal inclusions. Basalt type: SG 2.70 - 2.90 Tradename "snowflake": black bodycolor with white patches.		OBSIDIAN NATURAL GLASS (Volcanic)	127		
128	MOLDAVITE NATURAL GLASS (Tekite)	1	1.490	+0.020-0.010																						Round and elongated gas bubbles, flow lines "heat-wave" effect.		MOLDAVITE NATURAL GLASS (Tekite)	128		
129	CALCITE	5	1.658-1.486		.172																					Step-like fracture in single crystals, granular to uneven in aggregate. Onyx marble, marble often dyed, confused with agate chalcedony. Effervesces to HCl.	Dyed	CALCITE	129		
130	CORAL CALCAREOUS	0	1.658-1.486		.172																					Branch-like forms, polyp cavities, often dyed. Confused with shell, Gilson imitation Effervesces to HCl.	Dyed	CORAL CALCAREOUS	130		
131	SODALITE	T	1.483	+0.004-0.003																						TI-O blue-violet often white vein look like lapis lazuli, rarely contain pyrite. Hackmanite: Tp colorless, often change to pink after exposure to UV and rapid fade.		SODALITE	131		
132	NATROLITE	O	1.493-1.480	+0.003-0.007	.013																					Facetable crystals are rare. The only DR stone with RI entirely below 1.50.		NATROLITE	132		
133	OPAL	B	1.450	+0.020-0.080																						Key to separation from synthetic opal is "no snakeskin", "no columnar structure". Key to separation from imitations (glass, plastic): RI and SG. May phosphoresce.	Sugar, Smoke-treated	OPAL	133		
134	SYN. OPAL GILSON	E	1.450	+0.020-0.020																						Play-of-color stones: "snakeskin", "columnar structure", often no phosphoresce.		SYN. OPAL GILSON	134		
135	GLASS Man-made	L	1.700-1.470																							Gas bubbles, flow(swirl) lines, strong ADR (snake-like band), warm to touch. Molded glass: molded surface "orange-peel", "concave facets", "rounded junctions".		GLASS Man-made	135		
136	PLASTIC	O	1.700-1.460																							Gas bubbles, flow(swirl) lines, strong ADR (snake-like band), warm to touch. Molded surface "orange-peel", "concave facets", "rounded junctions".		PLASTIC	136		
137	FLUORITE	W	1.434	+0.001-0.002																						Tetrahedral 2-phase inclusions, color zoning. Often fluoresces moderate to strong. Variety Blue John: massive with banding.		FLUORITE	137		
138	ASSEMBLED STONE			Any																						Any combination of characteristics possible, Key tests: magnification, immersion, RI top and bottom, separation plane.		ASSEMBLED STONE	138		

TERMS AND ABBREVIATIONS

GEM

Black color name = common in market
Brown color name = not common in market (collector gem)
Red color name = man-made material

R.I. = Refractive Index

Com = most common R.I.
Bire = birefringence

Transp = Transparency

Tp = transparent
S-Tp = semitransparent
TI = translucent
S-TI = semitranslucent
O = opaque

COLOR

— (Horizontal line) = common color
U = uncommon color
Half box = secondary (modifying) color

C = colorless
P = purple
R = red
O = orange
Y = yellow
G = green
B = blue
V = violet
Br = brown
W = white
Gr = gray
Bl = black

Phenom = Phenomena

A = asterism
Ad = adularescence
Av = aventurescence
C = chatoyancy
CC = color-change
I = iridescence
L = labradorescence
O = orient
P = play-of-color

Other Visual observations

Ex = extreme
St = strong
Mod = moderate
Wk = weak
Disp. = dispersion

Optic Ch. = Optic character

DR = doubly refractive
SR = singly refractive
ADR = anomalous double refraction
AGG = aggregate
U = uniaxial
B = biaxial
+ = positive
- = negative

Pleo. = Pleochroism

2 = 2 colors (dichroism)
3 = 3 colors (trichroism)
S = strong
M = moderate
W = weak

Spectrum (nanometer)

*** = usually found
** = less often found
(blank) = sometimes found
or none found

Fracture/Cleavage

Con = conchoidal
Gra = granular
Spl = splintery
Step = step-like
Une = uneven
CL = cleavage
Dist. = distinct
Dir. = direction
Per. = perfect

UV = Ultraviolet Fluorescence

LW = long-wave ultraviolet
SW = short-wave ultraviolet
St = strong reaction
Mod = moderate reaction
Wk = weak reaction
Non = no reaction (inert)

Common Characteristics

Frac. = fracture
HCl = hydrochloric acid
Incl. = inclusion
Liq. = liquid
Nat. = natural
see-thru = see-through effect
SG = specific gravity
Syn. = synthetic