

GEL 3050 - Mineralogy - Optical Mineralogy

Disclaimer: These reviews are courtesy of the instructor. While care has been taken to include everything that might be tested, omissions or oversights may have occurred. The instructor shall NOT be liable for any missed answer on your part just because the topic is not explicitly mentioned. It is still the STUDENT'S RESPONSIBILITY to know and be able to use concepts addressed during lectures, labs, or required texts.

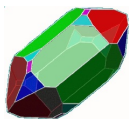
Mineralogy IN-CLASS Exam Review Sheet & Sample Exam:

BOLD = Minerals you must be able to identify WITHOUT the aid of written material

Normal = Minerals you should be able to identify WITH the aid of written material.

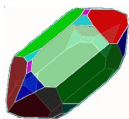
Important: **You must know mineral name, chemical formula, crystal structure and mineral group for each.**

<u>Mineral Name</u>	<u>Chem. Formula</u>	<u>Crystal Structure</u>	<u>Mineral Group</u>
Anatase (= Octahedrite)	TiO ₂	Tetragonal	Oxide
Andalusite	Al ₂ SiO ₅	Orthorhombic	Nesosilicate
Anhydrite	CaSO₄	Orthorhombic	Sulfate
Apatite	Ca₅(F₃Cl)(PO₄)₃	Hexagonal	Phosphate
Arsenopyrite	FeAsS	Orthorhombic	Sulphide
Augite (Pyroxene)	Ca(Mg, Fe, Al)(Al,Si)₂O₆	Monoclinic	Inosilicate
Azurite	Cu ₃ (CO ₃) ₂ (OH) ₂	Monoclinic	Carbonate
Barite	BaSO₄	Orthorhombic	Sulfate
Bauxite	Al ₂ O ₃ * 2H ₂ O	None	Oxide (Mixture)
Beryl	Be ₃ Al ₂ Si ₆ O ₁₈	Hexagonal	Cyclosilicate
Biotite (Mica)	K(Mg,Fe)₃AlSi₃O₁₀(OH)₂	Monoclinic (small angle)	Phyllosilicate
Bornite	Cu ₅ FeS ₄	Isometric	Sulphide
Brookite	TiO ₂	Orthorhombic	Oxide
Calcite	CaCO₃	Hexagonal-Rhombohedral	Carbonate
Chalcopyrite	CuFeS ₂	Tetragonal	Sulphide
Chlorite	(MgFe)₅Al₂Si₃O₁₀(OH)₈	Monoclinic	Phyllosilicate
Chromite	Fe ₂ Cr ₂ O ₄	Isometric	Oxide



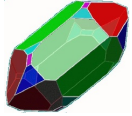
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<u>Mineral Name</u>	<u>Chem. Formula</u>	<u>Crystal Structure</u>	<u>Mineral Group</u>
Cinnabar	HgS	Hexagonal-Rhombohedral	Sulphide
Copper	Cu	Isometric	Native Mineral
Cordierite	(Mg, Fe) ₂ Al ₄ Si ₅ O ₁₈	Orthorhombic	Cyclosilicate
Corundum	Al₂O₃	Hexagonal	Oxide
Dolomite	CaMg(CO₃)₂	Hexagonal-Rhombohedral	Carbonate
Epidote	Ca ₂ (Al,Fe) ₃ (SiO ₄) ₃ OH	Monoclinic	Sorosilicate
Fluorite	CaF₂	Isometric	Halide
Galena	PbS	Isometric	Sulphide
Garnet Group	X ₃ Y ₂ (SiO ₄) ₃ <i>X: divalent metals (Ca, Fe, Mg, &/or Mn)</i> <i>Y: trivalent metals (Al, Cr, Fe, &/or Mn)</i>	Isometric	Nesosilicate
Graphite	C	Hexagonal-Rhombohedral	Native Mineral
Gypsum	CaSO₄*2H₂O	Monoclinic	Sulfate
Halite	NaCl	Isometric	Halide
Hematite	Fe₂O₃	Hexagonal-Rhombohedral	Oxide
Hornblende (Amphibole)	Ca₂Na(Mg,Fe)₄(Al, Fe,Ti)₃Si₆O₂₂(O,OH)₂	Monoclinic	Inosilicate
Ilmenite	FeTiO ₃	Hexagonal	Oxide
Kaolinite (Clay)	Al₂Si₂O₅(OH)₄	Monoclinic	Phyllosilicate
Kyanite	Al ₂ SiO ₅	Triclinic	Nesosilicate
Limonite	FeO(OH)*nH₂O	None	Oxide
Magnetite	Fe₃O₄	Isometric	Oxide
Malachite	Cu ₂ CO ₃ (OH) ₂	Monoclinic	Carbonate
Microcline (Feldspar)	KAlSi₃O₈	Triclinic	Tectosilicate
Molybdenite	MoS ₂	Hexagonal	Sulphide
Muscovite (Mica)	KAl₃Si₃O₁₀(OH)₂	Monoclinic	Phyllosilicate



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<u>Mineral Name</u>	<u>Chem. Formula</u>	<u>Crystal Structure</u>	<u>Mineral Group</u>
Octahedrite (= Anatase)	TiO ₂	Tetragonal	Oxide
Olivine <i>Fosterite</i> <i>Fayalite</i>	(Mg,Fe)SiO₄ <i>MgSiO₄</i> <i>FeSiO₄</i>	Orthorhombic	Nesosilicate
Orthoclase (Feldspar)	KAlSi₃O₈	Monoclinic	Tectosilicate
Orpiment	As ₂ S ₃	Monoclinic	Sulphide
Plagioclase (Feldspar) <i>Albite</i> <i>Labradorite</i> <i>Anorthite</i>	<i>NaAlSi₃O₈</i> <i>solid solution series</i> <i>CaAl₂Si₂O₈</i>	Triclinic	Tectosilicate
Pyrite	FeS₂	Isometric	Sulphide
Pyrolusite	MnO ₂	Tetragonal	Oxide
Quartz	SiO₂	Hexagonal	Tectosilicate
Realgar	AsS	Monoclinic	Sulphide
Rutile	TiO ₂	Tetragonal	Oxide
Sillimanite	Al ₂ SiO ₅	Orthorhombic	Nesosilicate
Sphalerite	ZnS <i>(may contain Fe, Mn, Cd)</i>	Isometric	Sulphide
Sphene / Titanite	CaTiSiO ₅	Monoclinic	Nesosilicate
Staurolite	FeAl ₄ Si ₂ O ₁₀ (OH) ₂	Pseudo-Orthorhombic	Nesosilicate
Stibnite	Sb ₂ S ₃	Orthorhombic	Sulphide
Sulphur	S	Orthorhombic	Native Mineral
Sylvite	KCl	Isometric	Halide
Talc	Mg₃Si₄O₁₀(OH)₂	Monoclinic	Phyllosilicate
Topaz	Al ₂ SiO ₄ (F,OH)	Orthorhombic	Nesosilicate
Tourmaline	Na(Mg,Fe,Li,Al,Mn) ₃ Al ₆ (BO ₃) ₃ (Si ₆ O ₁₈)(OH,F) ₄	Hexagonal	Cyclosilicate
Zircon	ZrSiO ₄	Tetragonal	Nesosilicate



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The following pages contain an actual IN-CLASS mineralogy exam so you know what questions are asked and which lab equipment from your kit you should bring. There are several versions of the exam. The layout is exactly the same for each, only the sample numbers and specimens will change with each version.

Note: The Exam numbering has no resemblances to any numbering of specimens in the lab or your kits(s)

Note: The IN-CLASS version of the Mineral Exam can be taken **only ONCE, there are **NO retakes**.**

The IN-CLASS mineralogy exam is a **closed** book / note exam. You are NOT allowed to use ANY written material, including booklets, pamphlets, lab manual, trifold brochures etc. This includes any writing or labeling on your rock / mineral specimens in your kit!

You may use calculators (NO cell-phone!) and ALL the tools from your Mineral ID kits, both the GEL1010 kit and the GEL3050 kit!

Name:	
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For Instructor use only:

GRADE:	/20
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This is a closed book / note exam. You are NOT allowed to use ANY written material, including booklets, pamphlets, lab manual and trifold brochures etc.

You may use calculators (NO cell-phone!) and ALL the tools from your Mineral ID kit!

Please Answer Below:

1.	1	Obtain mineral sample #1 and test for hardness. What is the most likely hardness of that mineral? <i>Note: Minerals may contain impurities. Make sure you test the actual mineral.</i>	Bubble in your correct answer: <input type="radio"/> 1 <input type="radio"/> 1.5 <input type="radio"/> 2 <input type="radio"/> 2.5 <input type="radio"/> 3 <input type="radio"/> 3.5 <input type="radio"/> 4 <input type="radio"/> 4.5 <input type="radio"/> 5 <input type="radio"/> 5.5 <input type="radio"/> 6 <input type="radio"/> 6.5 <input type="radio"/> 7 <input type="radio"/> 7.5 <input type="radio"/> 8 <input type="radio"/> 8.5 <input type="radio"/> 9 <input type="radio"/> 9.5
	1	Obtain one of the smaller pieces of mineral sample #1. What is the most likely specific gravity of that mineral? <i>Note: Minerals may contain impurities. Make sure you test the actual mineral.</i>	Bubble in your correct answer: <input type="radio"/> < 2.2g/cm ³ <input type="radio"/> 2.2 - 2.4g/cm ³ <input type="radio"/> 2.4 - 2.6g/cm ³ <input type="radio"/> 2.6 - 2.8g/cm ³ <input type="radio"/> 2.8 - 3.0g/cm ³ <input type="radio"/> 3.0 - 3.2g/cm ³ <input type="radio"/> 3.2 - 3.4g/cm ³ <input type="radio"/> 3.4 - 3.6g/cm ³ <input type="radio"/> 3.6 - 3.8g/cm ³ <input type="radio"/> 3.8 - 4.0g/cm ³ <input type="radio"/> 4.0 - 4.2g/cm ³ <input type="radio"/> 4.2 - 4.4g/cm ³ <input type="radio"/> 4.4 - 4.6g/cm ³ <input type="radio"/> 4.6 - 4.8g/cm ³ <input type="radio"/> 4.8 - 5.0g/cm ³ <input type="radio"/> 5.0 - 5.2g/cm ³ <input type="radio"/> 5.2 - 5.4g/cm ³ <input type="radio"/> 5.4 - 5.6g/cm ³ <input type="radio"/> 5.6 - 5.8g/cm ³ <input type="radio"/> > 5.8g/cm ³
2.	1	Obtain mineral sample #3 and test for hardness. What is the most likely hardness of that mineral? <i>Note: Minerals may contain impurities. Make sure you test the actual mineral.</i>	Bubble in your correct answer: <input type="radio"/> 1 <input type="radio"/> 1.5 <input type="radio"/> 2 <input type="radio"/> 2.5 <input type="radio"/> 3 <input type="radio"/> 3.5 <input type="radio"/> 4 <input type="radio"/> 4.5 <input type="radio"/> 5 <input type="radio"/> 5.5 <input type="radio"/> 6 <input type="radio"/> 6.5 <input type="radio"/> 7 <input type="radio"/> 7.5 <input type="radio"/> 8 <input type="radio"/> 8.5 <input type="radio"/> 9 <input type="radio"/> 9.5
	1	Obtain one of the smaller pieces of mineral sample #3. What is the most likely specific gravity of that mineral? <i>Note: Minerals may contain impurities. Make sure you test the actual mineral.</i>	Bubble in your correct answer: <input type="radio"/> < 2.2g/cm ³ <input type="radio"/> 2.2 - 2.4g/cm ³ <input type="radio"/> 2.4 - 2.6g/cm ³ <input type="radio"/> 2.6 - 2.8g/cm ³ <input type="radio"/> 2.8 - 3.0g/cm ³ <input type="radio"/> 3.0 - 3.2g/cm ³ <input type="radio"/> 3.2 - 3.4g/cm ³ <input type="radio"/> 3.4 - 3.6g/cm ³ <input type="radio"/> 3.6 - 3.8g/cm ³ <input type="radio"/> 3.8 - 4.0g/cm ³ <input type="radio"/> 4.0 - 4.2g/cm ³ <input type="radio"/> 4.2 - 4.4g/cm ³ <input type="radio"/> 4.4 - 4.6g/cm ³ <input type="radio"/> 4.6 - 4.8g/cm ³ <input type="radio"/> 4.8 - 5.0g/cm ³ <input type="radio"/> 5.0 - 5.2g/cm ³ <input type="radio"/> 5.2 - 5.4g/cm ³ <input type="radio"/> 5.4 - 5.6g/cm ³ <input type="radio"/> 5.6 - 5.8g/cm ³ <input type="radio"/> > 5.8g/cm ³

3.	Total 4	MINERAL IDENTIFICATION: Obtain Mineral Sample #4 from the instructor. Identify the mineral and complete the answers below:	
	2	Mineral Name of Sample #4: <i>You may write down two mineral names for ½ credit.</i>	
	1	Chemical formula of Sample #4:	
	0.5	Crystal Class / Group of Sample #4: Bubble in your correct answer: <input type="radio"/> Isometric <input type="radio"/> Tetragonal <input type="radio"/> Orthorhombic <input type="radio"/> Monoclinic <input type="radio"/> Triclinic <input type="radio"/> Hexagonal <input type="radio"/> Hex.-Rhombohedral	
	0.5	Mineral Group of Sample #4: Bubble in your correct answer: <input type="radio"/> Nesosilicate <input type="radio"/> Sorosilicate <input type="radio"/> Inosilicate (Pyroxene) <input type="radio"/> Inosilicate (Amphibole) <input type="radio"/> Cyclosilicate <input type="radio"/> Tectosilicate <input type="radio"/> Phyllosilicate (Mica) <input type="radio"/> Phyllosilicate (Clay) <input type="radio"/> Sulfide <input type="radio"/> Sulfate <input type="radio"/> Carbonate <input type="radio"/> Oxide <input type="radio"/> Phosphate (or related) <input type="radio"/> Halide <input type="radio"/> Native	
4.	Total 4	MINERAL IDENTIFICATION: Obtain Mineral Sample #5 from the instructor. Identify the mineral and complete the answers below:	
	2	Mineral Name of Sample #5: <i>You may write down two mineral names for ½ credit.</i>	
	1	Chemical formula of Sample #5:	
	0.5	Crystal Class / Group of Sample #5: Bubble in your correct answer: <input type="radio"/> Isometric <input type="radio"/> Tetragonal <input type="radio"/> Orthorhombic <input type="radio"/> Monoclinic <input type="radio"/> Triclinic <input type="radio"/> Hexagonal <input type="radio"/> Hex.-Rhombohedral	
	0.5	Mineral Group of Sample #5: Bubble in your correct answer: <input type="radio"/> Nesosilicate <input type="radio"/> Sorosilicate <input type="radio"/> Inosilicate (Pyroxene) <input type="radio"/> Inosilicate (Amphibole) <input type="radio"/> Cyclosilicate <input type="radio"/> Tectosilicate <input type="radio"/> Phyllosilicate (Mica) <input type="radio"/> Phyllosilicate (Clay) <input type="radio"/> Sulfide <input type="radio"/> Sulfate <input type="radio"/> Carbonate <input type="radio"/> Oxide <input type="radio"/> Phosphate (or related) <input type="radio"/> Halide <input type="radio"/> Native	

5.	Total 4	MINERAL IDENTIFICATION: Obtain Mineral Sample #9 from the instructor. Identify the mineral and complete the answers below:	
	2	Mineral Name of Sample #9: <i>You may write down two mineral names for ½ credit.</i>	
	1	Chemical formula of Sample #9:	
	0.5	Crystal Class / Group of Sample #9: Bubble in your correct answer: <input type="radio"/> Isometric <input type="radio"/> Tetragonal <input type="radio"/> Orthorhombic <input type="radio"/> Monoclinic <input type="radio"/> Triclinic <input type="radio"/> Hexagonal <input type="radio"/> Hex.-Rhombohedral	
	0.5	Mineral Group of Sample #9: Bubble in your correct answer: <input type="radio"/> Nesosilicate <input type="radio"/> Sorosilicate <input type="radio"/> Inosilicate (Pyroxene) <input type="radio"/> Inosilicate (Amphibole) <input type="radio"/> Cyclosilicate <input type="radio"/> Tectosilicate <input type="radio"/> Phyllosilicate (Mica) <input type="radio"/> Phyllosilicate (Clay) <input type="radio"/> Sulfide <input type="radio"/> Sulfate <input type="radio"/> Carbonate <input type="radio"/> Oxide <input type="radio"/> Phosphate (or related) <input type="radio"/> Halide <input type="radio"/> Native	
6.	Total 4	MINERAL IDENTIFICATION: Obtain Mineral Sample #12 from the instructor. Identify the mineral and complete the answers below:	
	2	Mineral Name of Sample #12: <i>You may write down two mineral names for ½ credit.</i>	
	1	Chemical formula of Sample #12:	
	0.5	Crystal Class / Group of Sample #12: Bubble in your correct answer: <input type="radio"/> Isometric <input type="radio"/> Tetragonal <input type="radio"/> Orthorhombic <input type="radio"/> Monoclinic <input type="radio"/> Triclinic <input type="radio"/> Hexagonal <input type="radio"/> Hex.-Rhombohedral	
	0.5	Mineral Group of Sample #12: Bubble in your correct answer: <input type="radio"/> Nesosilicate <input type="radio"/> Sorosilicate <input type="radio"/> Inosilicate (Pyroxene) <input type="radio"/> Inosilicate (Amphibole) <input type="radio"/> Cyclosilicate <input type="radio"/> Tectosilicate <input type="radio"/> Phyllosilicate (Mica) <input type="radio"/> Phyllosilicate (Clay) <input type="radio"/> Sulfide <input type="radio"/> Sulfate <input type="radio"/> Carbonate <input type="radio"/> Oxide <input type="radio"/> Phosphate (or related) <input type="radio"/> Halide <input type="radio"/> Native	