UMSO Rocks and Minerals 2018 Answer Key

Station 1 **(9)**

1. Give the name of each specimen. (4)
    a. Sample 1A: K-feldspar, orthoclase
    b. Sample 1B: olivine
    c. Sample 1C: gypsum
    d. Sample 1D: plagioclase feldspar
2. Identify the type of each sample (i.e. rock type, mineral class) (4)
    a. Sample 1A: silicate, feldspar-potassium
    b. Sample 1B: silicate
    c. Sample 1C: sulfate
    d. Sample 1D: silicate, feldspar-plagioclase
3. What is an important economic use of sample 1B? (1)
    - Gemstone, used in metallurgical processes as a slag conditioner, added to blast furnaces to remove impurities from steel and to form a slag, refractory material

Station 2 **(12)**

1. Give the name of each specimen. (5)
    a. Sample 2A: Halite
    b. Sample 2B: Calcite
    c. Sample 2C: Rose Quartz
    d. Sample 2D: Crystal Quartz
    e. Sample 2E: Fluorite
2. Identify the type of each sample (i.e. rock type, mineral class) (5)
    a. Sample 2A: halide
    b. Sample 2B: carbonate
    c. Sample 2C: silicate
    d. Sample 2D: silicate
    e. Sample 2E: halide
3. Samples A and B have a very similar appearance. What key characteristic regarding their cleavage differentiates the two?
    - Angle, angle of halite is 90 degrees, calcite is less than 90 (2)
    - Will also accept halite has perfect cleavage, whereas calcite is rhombohedral

Station 3 **(8)**

1. Give the name of each specimen. (2)
    a. Sample 3A: Basalt
    b. Sample 3B: Granite
2. For each sample, identify whether its composition is mafic, felsic, or intermediate. If not igneous, then what is the rock type? (2)
    a. Sample 3A: mafic, extrusive igneous
    b. Sample 3B: felsic, intrusive igneous

3. What causes the difference in color between mafic, felsic, and intermediate rocks? (2)
    - Caused by the increasing concentration of lighter colored minerals like silicates and feldspars (1)
    - In the order of mafic, intermediate, felsic, the color becomes lighter because concentration increases in this order (1)
4. Each specimen is formed within a specific volcanic setting – either above or beneath Earth's surface. In what way does the formation of each sample differ? (2) (tie-breaker #3)
    a. Sample 3A: basalt is extrusive so it cools rapidly when magma reaches surface
    b. Sample 3B: granite is intrusive so it cools slowly below the surface

Station 4 **(12)**

1. Give the name of each specimen. (3)
    a. Sample 4A: Pyrite
    b. Sample 4B: chalk limestone
    c. Sample 4C: Marble
2. Identify the type of each sample (i.e. rock type, mineral class) (3)
    a. Sample 4A: sulfide
    b. Sample 4B: sedimentary
    c. Sample 4C: metamorphic, non-foliated
3. Sample 4A is often mistaken for gold; however, several characteristics differentiate the two. Compare their specific gravity, hardness, and streak. (3)
    - Gold has a hardness of 3 – 4, pyrite: 6 to 6.5; also accept gold is softer (1)
    - Gold has a yellow streak, pyrite has a greenish black streak (1)
    - Gold has a higher specific gravity: 19.32 to pyrite's 5 (1)
4. Aside from their similar appearance, give another reason as to why Sample 4A might be mistaken for gold. (1)
    - Form under similar conditions and occur together in same rocks, or
    - Gold can occur as an inclusion or substitution within pyrite
5. Is there any relationship between Samples B and C. If so, what is it?
    - Yes, limestone is parent rock to marble (2)

Station 5 **(7**)

1. Give the name of each specimen. (2)
    a. Sample 5A: Staurolite
    b. Sample 5B: almandine
2. Identify the type of each sample (i.e. rock type, mineral class) (2)
    a. Sample 5A: silicate
    b. Sample 5B: silicate
3. Sample 5A has a distinctive crystal structure. What is the name of this structure?
    - Twin crystals (1)

4. Describe the formation of this crystal structure.
    - Crystalline materials form aggregates made up of individual single crystals joined together by one or more macroscopic symmetry relations (1)
5. What is an economic use of sample B? (1)
    - Used as gemstone, used as abrasive, cutting, and filter media, used for waterjet cutting, “sand” blasting, sand paper, water filtration

Station 6: Igneous Rock Terms (5)

1. porphyritic
2. Flow structure
3. Vesicle
4. Flux melting
5. Flow banding

Station 7 **(8)**

1. Give the name of each specimen. (3)
    a. Sample 7A: Gabbro
    b. Sample 7B: andesite
    c. Sample 7C: rhyolite
2. Identify the type of each sample (i.e. rock type, mineral class) (3)
    a. Sample 7A: intrusive igneous
    b. Sample 7B: extrusive igneous
    c. Sample 7C: extrusive igneous
3. Sample 7B and C are typical volcanic rocks. What type of volcano is associated with these types of rock. (tie-breaker #2)
    - Stratovolcano or composite for both types (2)

Station 8 **(10)**

1. Give the name of each specimen. (3)
    a. Sample 8A: Pumice
    b. Sample 8B: Obsidian
    c. Sample 8C: Biotite
2. Identify the type of each sample (i.e. rock type, mineral class) (3)
    a. Sample 8A: extrusive igneous
    b. Sample 8B: extrusive igneous
    c. Sample 8C: silicate-mica
3. What are at least two similarities and two differences between Samples A and B? (4)
    - Similarities: types of volcanic glass (extrusive igneous rocks will get one point only), felsic composition. (1 for each, 2 total)
    - Differences: texture of pumice is vesicular, obsidian is glassy, conchoidal (2)

Station 9: Sedimentary Rock Terms **(4)**

1. Arrangement of minor beds or laminae, within a stratified rock, more or less inclined to the depositional surface, with straight sloping or concave surfaces at various angles

2. Roughly spherical or rounded, more or less symmetrical structures in clastic sedimentary rocks; formed by the accumulations and concentration of mineral matter around a nucleus
3. Rock formed by the accumulation of fragments derived from preexisting rocks and minerals by mechanical weathering and transported to their places of deposition by purely mechanical agents
4. Precipitated from water by inorganic processes

Station 10 (**8**)

1. Give the name of each specimen. (2)
    a. Sample 10A: talc
    b. Sample 10B: coquina
2. Identify the type of each sample (i.e. rock type, mineral class) (2)
    a. Sample 10A: silicate
    b. Sample 10B: limestone, biological, sedimentary
3. Using Moh's hardness scale, what is the hardness of each sample? (2)
    a. Sample 10A: 1
    b. Sample 10B: not applicable, Moh's scale is used for mineral identification
4. Describe the formation of Sample B. (2)
    - Poorly cemented limestone that consists of mechanically transported fossil debris
    - Form in zones of high energy where finer material is swept away

Station 11 (**11)**

1. Give the name of each specimen. (3)
    a. Sample 11A: Hematite
    b. Sample 11B: Magnetite
    c. Sample 11C: Galena
2. Identify the mineral habit of each sample. If not a mineral, indicate as such. (3)
    a. Sample 11A: hexagonal
    b. Sample 11B: isometric
    c. Sample 11C: isometric
3. What is the streak color of each sample? If not a mineral, indicate as such. (3)
    a. Sample 11A: red/brown
    b. Sample 11B: white/gray
    c. Sample 11C: black/dark gray
4. List a unique property for Sample 11B and 11C. (2)
    a. Sample 11B: magnetic
    b. Sample 11C: unusually heavy/ high specific gravity

Station 12 (10)

1. Give the name of each specimen. (3)
    a. Sample 12A: conglomerate
    b. Sample 12B: oolitic limestone
    c. Sample 12C: quartzite

2. Identify the type of each sample (i.e. rock type, mineral class) (3)
    a. Sample 12A: sedimentary, clastic
    b. Sample 12B: sedimentary, chemical
    c. Sample 12C: metamorphic, nonfoliated
3. Describe the angularity and clast size of each. If not sedimentary, indicate as such. (4)
    a. Sample 12A: rounded angularity, medium to large clast size (2)
    b. Sample 12B: not clastic, (1); may also accept highly rounded oolites
    c. Sample 12C: not sedimentary (1)

Station 13: Metamorphic Rock Terms (5)

1. recrystallization
2. neocrystallization
3. Pressure solution
4. Plastic deformation
5. Contact metamorphism

Station 14: (**16)**

1. Give the name of each specimen. (4)
    a. Sample 14A: slate
    b. Sample 14B: schist mica
    c. Sample 14C: phyllite
    d. Sample 14D: gneiss
2. Each of the samples are of the same type: foliated metamorphic rock. List the processes during which foliation takes place. (3)
    - Growth (1), bending/deformation (1), rotation of minerals (1)
    - May also accept heat/pressure, stress
3. What are the three main types of metamorphism, and in which type does foliation take place? (4)
    - Regional, contact, dynamic (includes hydrothermal, burial, impact) (3)
    - Occurs in regional (1)
4. Give the metamorphic grade for each sample. (4)
    a. Low grade
    b. Low to middle grade
    c. Low grade
    d. High grade
5. List the samples in the order of metamorphism.
    - Slate, phyllite, schist, gneiss (1)

Station 15: Silicate Tie breaker **(15) (Tie breaker is total points for station)**

1. Silicate group is the most abundant because silicon and oxygen are most abundant elements in Earth's crust (28% and 46% respectively). (1)
2. List five types of silicates. Give an example of each (10)
    - Isolated tetrahedra: olivine or garnet (2)

- Single chain: pyroxene (2)
- Double chain: amphibole (2)
- Two dimensional sheet: mica, talc (2)
- Three dimensional framework: quartz, feldspar (2)
- Several other examples exist for each type

3. In what ways does the silicate group relate to Bowen's reaction series (up to 4 points)
    - In the order of isolated tetrahedra, single chain, double chain, two-dimensional sheet, and framework, the silicon/oxygen ratio increases (1)
    - Composition of silicates (silicon/oxygen ratio) determines the melting point (1)
    - Minerals with lower Si/O ratios crystallize first/have higher melting points and minerals with higher ratios crystallize last/have lower melting points (1)
    - Order of silicates based on ratio corresponds to Bowen's Reaction Series (1)
    - Simply stating that only silicates are included in the reaction series will earn zero points