Student Self-Assessment Questions for Unit 4

These questions are included in the online reading in Student Materials

Question 1

This table shows how long it takes for different minerals to dissolve (the solution rates of minerals). From Drever, 1997 (pg. 233).

Mineral	Time it would take a hypothetical 1 mm sphere of this mineral to dissolve in water with pH=5 (years)
calcite	0.1
olivine (forsterite)	2300
plagioclase (albite)	575,000
mica (muscovite)	2,600,000
clay (kaolinite)	6,000,000
quartz	34,000,000

Based on the table, which mineral is most soluble (dissolves most easily)?

a. quartz
b. olivine
c. calcite

Question 2 Which of the following are examples of mechanical weathering?

a. Water fills a crack in the pavement. Overnight, the water freezes (and expands), so the pavement cracks even more.
b. A road crew used dynamite to blast away a hillside.
c. A teaspoon of salt dumped into a pot of boiling water dissolves.
d. The bumper of a 1989 Honda rusts.
e. Sediments (rocks) carried in a stream smash against each other, breaking off edges and corners.

Question 3 This table shows some economic minerals found in clastic sedimentary deposits and their common uses. Keep in mind that specific gravity is a way of measuring density.

Mineral	Commodity	Specific gravity	Some uses
various	gravel		construction
quartz	sand, silica	2.65 (quartz)	construction, glass, computer chips
rutile, ilmenite	titanium	4.18–4.25 (rutile), 4.7 (ilmenite)	white pigment (paint), titanium metal (airplanes)
chromite	chromium	4.6	stainless steel
rare-earth oxides	rare-earth elements (REE)		computer and television displays, fiber optic cables, magnets, catalytic converters in cars
cassiterite	tin	6.8–7.1	coating for tin cans, bronze
cinnabar	mercury	8.10	fluorescent lights, thermometers, production of chlorine
diamond	diamond	3.5	gemstones, abrasives
native copper	copper	8.9	wiring, antifungal and antibacterial chemicals
native silver	Silver	10.5	mirrors, photography, electronics
native gold	gold	15–19.3	jewelry, electronics, currency
native platinum	platinum	14–19	jewelry, catalytic converters in cars, dental equipment

Question 3a Imagine you have identically sized pebbles of the minerals below. Which one will be heaviest?

a. Quartz
b. Silver
c. Copper
d. Diamond

Question #3b Which erosion agent is most likely to pick up and carry (erode) the mineral pebble you selected?

a. A very fast moving stream
b. A gentle ocean wave
c. Wind

Question 4

This table shows concentrations of ions in different waters (composition of average seawater and brine from Great Salt Lake, Utah (from Drever, 1997) and freshwater (rain and river water; from Hem, 1985)). In the ocean and the Great Salt Lake, evaporation removes water, leaving other ions behind. This concentrates the ions (as you can see by comparing the amounts of ions in seawater and the Great Salt Lake with the ions in rain water and the Mississippi River). Note that brines, like that in the Great Salt Lake, are saltier than seawater; and while all brines are saltier than seawater, different brines will contain different amounts of certain ions.

Ion	Average seawater (mg/kg)	Great Salt Lake (mg/kg)	Rain water from Menlo Park, CA (mg/kg)	Mississippi River (mg/kg)
chloride	19,350	140,000	0.8–17	24
sodium	10,760	85,600	0–9.4	20
sulfate	2,710	16,400	0.7–7.6	51
magnesium	1,290	7,200	0.7–1.2	10
calcium	411	241	0.8–1.2	38
potassium	399	4,070	0	2.9
bicarbonate	142	251	4–7	113
silica	.5–10	48	0.3–1.2	7.9

Question 4a Which brine in the table has the highest salinity (contains the highest concentrations of dissolved ions)?

a. Rain water
b. River water
c. Ocean water
d. Water from Great Salt Lake

Question 4b Evaporite minerals readily form in the Great Salt Lake, and in the ocean. Why do minerals crystallize in these places?

a. Because concentrations of ions are high in these places.
b. Because little rain falls in these places.
c. Because these bodies of water are very large.
d. Because temperatures are very hot in these places.

References

Drever, James I. 1997. *The Geochemistry of Natural waters: Surface and Groundwater Environments*, 3rd Edition. Prentice Hall.

Hem, John D. 1985. *Study and Interpretation of the Chemical Characteristics of Natural Water*, 3rd Edition. USGS Water Supply Paper 2254.