Interpreting the Geologic History of the Grand Canyon
(Use your book and previous work but no cell phones or computers)

Based on the cross section of Grand Canyon on the next page answer the following:

1. What is the name of the oldest and youngest rock unit in the cross section? Oldest: Vishnu Schist, youngest: Chinle Formation.

2. Which is older, the Zoroaster Granite or Grand Canyon Super Group? How do you know? Zoroaster Granite is older because the Grand Canyon Super Group is above and not intruded by the Zoroaster.

3. There are 4 (A-D) unconformities shown on the cross section. There are 3 types of unconformities: nonconformity, disconformity, and angular-unconformity. Label each (A-D) as to type. A: nonconformity, B: angular unconformity, C: disconformity, D: disconformity.

4. Based only on the evidence in only cross section, discuss when the Colorado River seems to have begun to carve the Grand Canyon? Chinle Formation is the youngest and from the cross section looks like the Colorado began cutting after the Chinle was in place in the Triassic.

5. If you study the scientific literature you will find: “the Redwall Limestone, which is 400 to 800 feet thick, is composed of thick-bedded, dark brown to bluish gray limestone and dolomite with white chert nodules mixed in. It was laid down in a retreating shallow tropical sea near the equator during Mississippian (average age is 335 Ma). Geologists do know that before the deposition of the Redwall Limestone deep channels were carved on the top of the Cambrian Muav Limestone (average age 515 Ma). Streams were the probably cause. These depressions were filled with freshwater limestone in the Devonian (average age 350 Ma) with a formation that geologists call the Temple Butte Limestone. Marble Canyon in the eastern part of the park displays these filled purplish-colored channels well. Fossils of animals with backbones are found in this formation; bony plates from freshwater fish in the eastern part and numerous marine fish fossils in the western part. It should be obvious that an unconformity exists between the Temple Butte and the Muav since the Muav was eroded before deposition of the Temple Butte. Given all this information determine the time missing at the unconformity between the Temple Butte Limestone and Muav Limestone in years? 515-350 = 165 million years. Based on the missing time between the Temple Butte and Redwall Limestone another unconformity exists and this time gap is? 350-335 = 15 million years. Both of these unconformities would be what kind? Disconformities.

6. Tapeats Sandstone averages 525 million years old and is made of cliff-derived medium- to coarse-grained sand and conglomerate that was deposited along an ancient ocean shore. It contains some marine fossils. What fossils would you expect might be there? Trilobites.

7. The Tonto Group contains the Tapeats, Bright Angel and Muav. Do these represent a time of transgression, regression, stable marine platform or continental deposition? Explain the evidence. This looks like classic transgression based on fining up, shore to offshore, sequence (sand, shale, limestone).

8. There are fossils in the Bass Formation (not shown) which is at the bottom of the Grand Canyon Supergroup. The Bass is a shallow marine of limestone/dolomite, sandstone and shale and averages 1250 million years old. What are those fossils most likely to be? Precambrian marine environments of this age could contain stromatolites.

9. Inclusions, which are fragments of older rock within rock. Inclusions are a good way to tell relative age. Would you expect to find inclusions of the Vishnu in the Zoroaster or visa versa? Explain your reasoning. The Zoroaster being younger could have inclusions of older rock that dropped into the intruding magma.
