

GEO4-1403 Petrological and Geochemical Evolution of the Earth

EXAMPLE EXAM

Name: _____ Student number: _____

Answer **five out of eight questions**. You can choose which questions to answer.

All questions are worth 10 marks each

Write your answers on the paper attached. Use both sides of the sheets.

In each answer, give as much detail as you can about petrological and geochemical evidence that supports the key processes in question.

1. (a) What evidence is available to show that the Earth's crust began to form in Hadean times? (b) Was the Earth likely to have been habitable to microbial life at this point in time? Which evidence can be used to support this?
2. (a) What is the earliest material preserved in meteorites, formed only a few million years after nucleosynthesis? (b) Assuming that the moon was formed from a giant impact between the proto-Earth and an impactor called Theia, how could we go about dating this event?
3. (a) Which stable isotope systems might be best suited to tracing life on Mars and why? (b) Would this approach also be suited to tracing the earliest life on Earth, and/or are there additional lines of evidence that could be followed in the terrestrial record?
4. (a) Which minerals were present under anoxic conditions of the Archean Earth that are not seen in modern ocean basins? (b) Describe in as much detail as you can how sulphur isotope variations in sedimentary rocks can be used to support the presence of a great oxygenation event at 2.32 Ga.
5. (a) How you would distinguish the igneous rock type *komatiite* in hand specimen and under the optical microscope. (b) How might komatiites be distinguished geochemically from the basalts that makes up the modern ocean basins?

6. (a) What is a large igneous province (LIP)? Give the most important characteristics that define an event as a LIP and briefly describe its relationship to global tectonic processes. (b) What are the main effects of a LIP event on global climate?
7. Describe (a) how Archean magmatic/volcanic rock types are distinctive, and (b) tectonic processes might be different, to those found on the modern Earth. Give as much detail as you can
8. (a) What is meant by the theory of mineral evolution? List the main stages that have been proposed for this theory. (b) What stage of mineral evolution has been reached on Mars at the present day?