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**Department of Earth sciences and petroleum**

**College of Science**

**University of Salahaddin**

**Subject: Practical Geochemistry 1**

**Course Book – Year 4**

**Lecturer's name: Rezhin Kamal Mustafa (MSc)**

**Academic Year: 2022/2023**

**Course Book**

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| **1. Course name** | **Practical Geochemistry 1** |
| **2. Lecturer in charge** | **Rezhin Kamal Mustafa (MSc)** |
| **3. Department/ College** |  |
| **4. Contact** | **e-mail: rezhin.mustafa@su.edu.krd****Tel: 009647504256696** |
| **5. Time (in hours) per week**  | **For example, Theory: 2** **Practical: 2**  |
| **6. Office hours** | **3-4 hours** |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | I received B.Sc. degree in geology from Salahaddin University- Erbil-Iraq, in 2013 and M.Sc. degree in Geochemistry from the same university in 2019. I am a member of staff in Department of Earth sciences & petroleum, College of Science, University of Salahaddin. I am a member of Kurdistan Geologists syndicate since 2009. |
| **9. Keywords** | **Geochemistry, science** |
| **10. Course overview:** This course focuses on the chemistry of the natural world and the chemical evolution of the Earth. We will discuss practical and theoretical geochemistry, with an emphasis on how chemical principles are used to study Earth Sciences. The course is composed of two modules: (a) geochemical fundamentals; (b) the origin and evolution of Earth and the solar system through nuclear and high temperature chemical processes. This course also focuses on the geochemistry of the igneous, sedimentary and metamorphic rocks. The last lab deal with the geochemistry of the isotopes which become very important at the last years.  |
| **11. Course objective:**The studying of this course, the students will be able to understand the geochemistry of the elements that are represented in the periodic table. Chemical characteristic and distribution of these elements in the lithosphere, is the aim for understanding the element. The students will be interested in the origin of the universe, solar system and the earth in addition to the origin of the elements that are formed due to the nuclear fusion of H, He, ....  The other part of the course will be deal with the isotopes (radioactive and stable). The students would be employed this subject in the estimation of the age of the formation of the studied rocks and prediction of the climate during the deposition and in some times the salinity of the water under which the minerals are deposited.  |
| **12. Student's obligation** The student’s obligation during the course is attendance in the lab for two hours for studying the practical part of the course. There are many tests before the beginning of the labs.  |
| **13. Forms of teaching** Different forms of teaching will be used to reach the objectives of the course: power point presentations for the titles and definitions and summary of conclusions, all figures that related to the lectures. Furthermore, students will go to the field to collect the samples then in the laboratory worked on it. After that, they wrote a report and do the presentation about the field. To get the best of the course, it is suggested that you attend lab as much as possible, read the required of the lab before the time of lecture, teacher's notes regularly as all of them are foundations for the course.  |
| **14. Assessment scheme**The students are required to do an exam after each six lectures. There is one practical exam at the end of the semester, in addition to quiz exams during course. - The final mark of semester is **50%**, and divided to: **15%** for theoretical part, and **35%** for practical part; also, the practical mark is divided to four marks: exam, weekly reports, activities and quizzes.- The final exam is from **50%** on theory Therefore, the total mark will be **100%**. |
| **15. Student learning outcome:** In the last years many oil companies come to Kurdistan Region for oil exploration and production, in a wide area along the region, so several geologists are followed these companies and others are work with the geological survey where the mineral resources are available in the region. Some of the students after graduation they employed in water resources companies in public and private sectors.  |
| **16. Course Reading List and References‌:**▪ Required books:1) White, W.M. 2005, Geochemistry, John Hopkins University Press, 701p.2) Brownlow, A.H., 1979, Geochemistry, Prentice-Hall, Inc., New Jersey, 498p. 3) Krauskopf, K., 1967, Introduction to geochemistry, McGraw-Hill, Inc., New York, 721p. Students are encouraged to search for the Journals and internet that may help them in this course, such as:1) Geochemica et Cosmochemica Acta*.*2) Chemical Geology 3) Geochemical exploration |
| **17. Practical Topics:** | **Lecturer's name** |
| *Week 1:* Introduction to thermodynamics (system, phase, components, thermal equilibrium).  *Week 2:* Laws of thermodynamics, Entropy, Enthalpy, Gibbs free energy and reaction curve.*Week 3:* Quiz for lab 1 and 2; Relative mobility of elements. *Week 4:* Calculation of hypothetical salt combination from water analysis.*Week 5:* Calculation of insoluble residue (I.R. %) by practical method. *Week 6:* Quiz for lab 3 and 4; Calculation of Ca/Mg ratio in water by EDTA method.  *Week 7:* Calculation of Ca/Mg ratio in carbonate rocks by EDTA method. *Week 8:* Calculation of K and Na by using flame photometer.*Week 9:* Quiz for lab 7 and 8; radioactive isotope geochemistry (Rb-Sr system).*Week 10:* Radioactive isotope geochemistry (U-Pb and Ar systems).*Week 11:* Practical midterm examination. | Dr.Awaz Karem.M.Sc. Zhin Saaib  MSc Rezhin K. Mustafa (2 hrs)ex: 12/9/2022 |
| **19. Examinations:****Q1: Answer the following** **questions** **briefly**? **(25M )** **1- What are major affects of increasing water pressure on Granitic magma?** **2- During α - decay radioactive , how the mass number and atomic number change ?.** **3- What is the synonym for incompatible trace elements?** **4- Write two ways use for stable isotopes.** **5-** **Why the elements that form the columns of the periodic table behave similarly largely?****Q2: Choose or give the correct answer : (25 M )** **1-** **The formation of wollastonite should be inhibited by high partial pressures of …. ( SO4 ) , ( H2O ) , ( CO2 )**  **2- High Field Strength Elements (HFSE) are typically …( Compatible ) , ( Incompatible ) , ( large ionic radius ) .**  **3- The element is incompatible if partition coefficient (D) ……. ( If D > 1 ), ( If D < 1 ) , (If D = 1 ) .**  **4- Among the first minerals to crystallize from ………………. magma are olivine and one or more pyroxenes.**  **( Dioriteic ) , ( Basaltic** **) , ( Granitic ) .**  **5- The highest limit of oxidation potential in natural Environments reduce 0.06 volt to all unit ………………..** **.** **( PH increasing ) , ( PH decreasing** **) , ( PH removing ) .** **Q3: Complete the following: (25M)** **1-Isotope that does not decay radioactively is ………………………. .** **2-……………………….. large gas cloud collapses. Its spin causes it to flatten in to a disk.** **3- ………………………meteorite consist essentially of one or two nickel-iron metallic phases and coarse-grained**  **intergrown crystal structure.** **4-** **In the “normal” differentiation process, the pyroxenes and olivines that crystallize first are rich ............……………..** **5- When metamorphism of ……………………… rocks occurs, the fugacity of CO2 becomes important.** |
| **20. Extra notes:** |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ** Assistant Prof. Dr. Farhad Ahmad Mohammed |