جامعة الملك سعود
King Saud University

# *Geochemistry Course*

Course Code # (Geo 451)

2nd Semester

The Academic Year

1442 - 2021

**The Course launched**

**On**

**Sun 4/06/1442 - 17 / 01 /2021**

*Course Director:*

*Dr. Bassam A. Abuamarah Al-Mohanna*

## a. Course General Information:

i. Course Director: *Dr. Bassam A. Abu Amarah Mohanna*
ii. Contributor: Mr. Hussam Tofahah
iii. Course Title: Geochemistry
iv. Course Code: 451 Geo
v. Credit hours: 2 credit hours (2(1+0+1)).
vi. Level/ year the course is offered: 2nd Semester (2021) of the 8th level / 4th year.
vii. Course pre-requisites: 221 Geo (Mineralogy course, 5th level.
viii. Lecture theater (room) & Time: B80/21 04 0140& Sun., 15:00 to 15:50 Pm

## b. Geochemistry

Is to study the interaction of Earth's minerals and natural compounds with the atmosphere and hydrosphere.

## c. Course Description:

Overview on the formation of the solar system and the synthesis of chemical elements; chemical equilibrium; acids and bases; distribution and geochemical classification of elements; salts and aqueous geochemistry; chemical weathering and mineral equilibria; introduction to oxidation-reduction reactions; isotope geochemistry: radioactive, radiogenic, and stable isotopes and their applications.

## d. Course objectives and Learning Outcomes for this Course:

a. *The course will give students* ***ability to*** understanding the composition of the Earth chemical elements distribution and their abundance compered with elements in the Solar composition

*a.* other terrestrial planets: Mercury, Venus, Mars, and the Moon

*b.* *The course will give students* ***ability to*** understanding and to view the chemical interactions that occur on the earth is to consider the earths, i.e. to understanding of chemical processes that are occurring and have occurred in the past is built on models/relations

*c.* *The course will provide students the knowledge* ***to distinguish*** the important basic chemical principles for studying the chemistry and geology of the earth geochemistry sciences that's become more environmentally oriented in recent years .

***d.*** *The course will give students the abilities to* ***identify to*** learn the basics of thermodynamics, and *Kinetic* concerned.

*e.* *The course will help students to launch* that magmas and minerals at high pressure and temperatures and, at the same time, take into account environmentally important processes on the earth's surface and its atmosphere.

*f.* *In addition, the course will give him* the ability how to characterize of water change in composition with this movement of water between environments, *and its relationships with the formation of different diversities of rocks.*

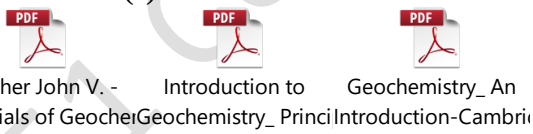
g. *The course will help* ***to*** divided between the two distinct groups of *radiogenic isotopes* that are produced radioactive decay of unstable parent nuclides; and *stable isotopes* that do not undergo radioactive decay.

## e. Course Evaluation during the running semester:

| *No* | *Evaluation Tasks* | *Week due* | *Proportion of the final evaluation % assessment* |
|---|---|---|---|
| *1* | *Homework +report & Attendance+ End lecture Question)* | *5 -9- 12 & All weeks days* | *10%* |
| *3* | *First test* | *9* | *15%* |
| *4* | *Practical test* | *13* | *20%* |
| *5* | *Second test* | *15* | *15%* |
| *6* | *Final Exam* | *16* | *40%* |

## f. Essential References and text books:

I. Required Text(s)




II. Principles and Applications of Geochemistry by Gunter Faure, 2nd ed., 1998

III. Electronic Materials, Web Sites etc
- Journal of African Earth Sciences
- Arabian Journal of Geosciences
- Saudi Geological Survey.

IV. Other learning material such as computer-based programs/CD, professional standards/regulations.

Course Outline.

# 1 What is Geochemistry? 2 In the Beginning 3 The Solar System 4 Chemical Differentiation of the Earth Principles of Inorganic Geochemistry 5 The Electronic Structure of Atoms 6 The Periodic Table and Atomic Weights 7 Chemical Bonds, Ionic Radii and Crystals 8 Ionic Substitution in Crystals TOG Trace Elements Manahan 10&14, Sustainability

book Green Chemistry, the Geosphere and Anthrosphere Aqueous Geochemistry and the Stability of Minerals 9 Acids and Bases 10 Salts and Their Ions 11 Thermodynamics 12 Mineral Stability Diagrams 14, Manahan 7 Oxidation-Reduction Reactions Isotope Geochemistry 16 Isotopic Geochronometers (Radioactive Isotopes) 17 Isotope Fractionation (Stable Isotopes)



**i.** ***Geology of the Arabian Shield Lecture's title outlines*: *Starts on Sun 24 /05/1441Corresp. 19/01/2020***

| *No. of Wk.* | *day* | *Week date* | *Lecture's Title* | No. Of Weeks | Contact hours |
|---|---|---|---|---|---|
| *1* | ***Sunday*** | **17 Jan. 2021** | ***Introduction***<br>• ***History of Geochemistry*** | **1** | **2** |
| *2* | ***Sunday*** | **24 Jan. 2021** | ***The earth in relation to the universe***<br>• ***Thr nature of the universe.***<br>• ***The age of the solar system***<br>• ***The Nature and origin of the solar system***<br>• ***The composition of the sun***<br>• ***The composition of the planets***<br>• ***The composition of Meteorites***<br>• ***The cosmic abundance of the elements***<br>• ***The origin of elements.*** | **1** | **2** |
| *3* | ***Sunday*** | **31 Jan. 2021** | ***The structure and composition of the Earth. Introduction.***<br>• ***Seismic data on the earth's Interior.***<br>• ***Density within the earth.***<br>• ***Temperature within the earth.***<br>• ***The Internal structure of the earth.***<br>• ***The Zonal structure of the earth.***<br>• ***The composition of the crust.***<br>• ***Composition of the earth as a whole.***<br>• ***The geo chemical classification of the elements.***<br>• ***The pre-geological history of the earth.*** | **1** | **2** |
| *4* | ***Sunday*** | **07 Feb. 2021** | ***Thermodynamics and crystal chemistry. Introduction***<br>• ***Fundamental of Thermodynamic equations.*** | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | | • *The state of Matter*<br>• *The crystalline state.*<br>• *Principales of crystal structure.*<br>• *The structure of silcates.*<br>• *Atomic substitution.*<br>• *Polymorphism.*<br>• | | |
| *5* | ***Sunday*** | **14 Feb. 2021** | ***Magmatism and Igneous rocks.***<br>• ***What is magma?***<br>• ***The mineralogical composition of igneous rocks***<br>• ***The silicate minerals(The feldspar Group, The feldspathoids, The pyroxene group, The amphibole group, The olivine group, The mica group).***<br>• ***The nature of silicate melts.***<br>• ***Crystallization in silicate melts.***<br>• ***The crystallization of magma.***<br>• ***Minor elements in magmatic crystallization***<br>• ***Resdidual solution and pegmatites.***<br>• ***The volatile components of a magma.***<br>• ***Magmatism and ore deposition.*** | **1** | **2** |
| *6* | ***Sunday*** | **21 Feb. 2021** | ***Sedimentation and sedimentary rocks.***<br>• ***Sedimentation as a geochemical process.***<br>• ***Soil chemistry.***<br>• ***The Chemical composition of sedimentary rocks.***<br>• ***The mineralogical composition of sedimentary rocks.***<br>• | 1 | **2** |
| *7* | ***Sunday*** | **28 Feb. 2021** | ***First Assessment Exam*** | **1** | **2** |
| *8* | ***Sunday*** | **07 Mar. 2021** | • ***Physicochemical Factors in sedimentation.***<br>• ***Ionic potential.***<br>• ***Hydrogen-Ion Concentration.***<br>• ***Oxidation-Reduction Potentials.***<br>• ***Colloids and Colloidal processes.***<br>• ***Product of Sedimentations***<br>***Total amount of sedimentation*** | **1** | **2** |
| *9* | ***Sunday*** | **14Mar. 2021** | ***Hydrosphere***<br>• ***The nature of the hydrosphere..***<br>• ***The composition of Sea water.*** | **1** | **2** |

| | | | | | |
|---|---|---|---|---|---|
| | | | ***The history and evolution of the Ocean.*** | | |
| *10* | ***Sunday*** | **22-26 Mar. 2020** | ***Hydrosphere***<br>• ***The nature of the hydrosphere..***<br>• ***The composition of Sea water.***<br><br>***The history and evolution of the Ocean.*** | **1** | **2** |
| *11* | ***Sunday*** | **21Mar. 2021** | ***The Atmosphere***<br>• ***The composition of the atmosphere.***<br>• ***The evolution of the Atomsphere.***<br>• ***Atmospheric addition & losses during geological time.*** | **1** | **2** |
| *12* | *Sunday* | **28 Mar. 2021** | ***The Atmosphere***<br>• ***Thecomposition of the atmosphere.***<br>• ***The evolution of the Atomsphere.***<br>• ***Atmospheric addition & losses during geological time.*** | **1** | **2** |
| *13* | *Sunday* | **04 Apr. 2021** | ***The biosphere***<br>• ***The nature of the biosphere.***<br>• ***The composition pf the Biosphere.***<br>• ***The origin of Coal.***<br>• ***The origin of Petroleum*** | **1** | **2** |
| *14* | *Sunday* | **11 Apr. 2021** | ***Metamorphism and Metamorphic rocks***<br>• ***Metamorphism as a geochemical process,***<br>• ***The chemical composition of metamorphic rocks.***<br>• ***Minerals in metamorphic rocks.***<br>• ***Accessory elements in metamorphic rocks*** | **1** | **2** |
| *15* | *Sunday* | **18 Apr. 2021** | ***Second assessment exam*** | **1** | **2** |
| | | ***24 Apr. 2021*** | ***General Course Exam*** | | |
| | | ***23 May 2021*** | ***Beginning of Semester Final Exam*** | | |



*Wishing you all the Best and Successes*

مع تمنياتي لكم بالتوفيق و النجاح

*Course Director:*

*Dr. Bassam A. Abuamarah Al-Mohanna*