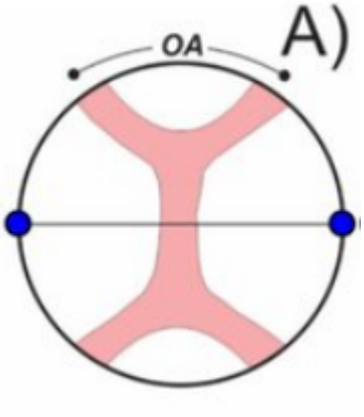
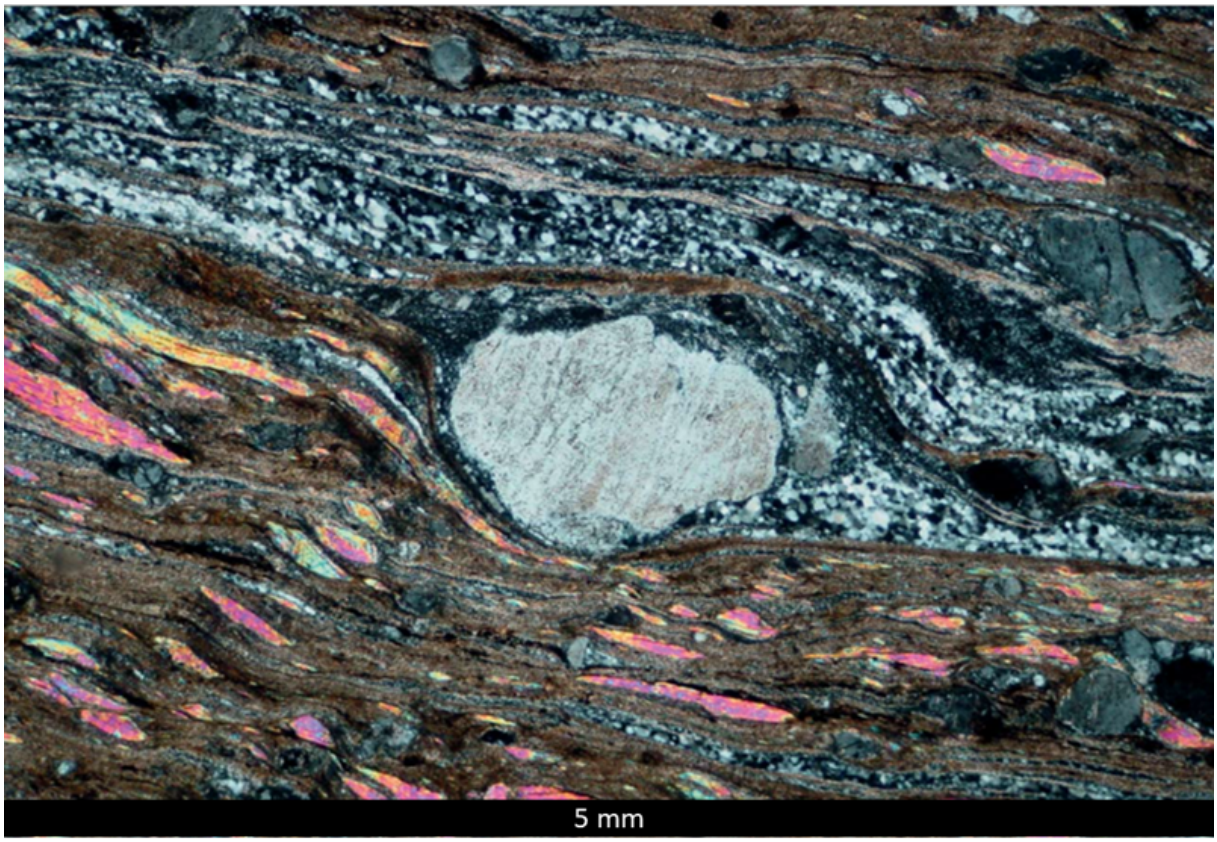
Master exam – questions and topics
Applied Geoscience 2023

1. Considering quarks – what happen while (resulting) a proton is turned into a neutron? Explanation+comment+application.
2. Difference between alfa (a) and Delta values (D) – when applicable (define, explain, examples)
3. Isomorphism
4. Nature and practical applications o radioactive dacay and thermonuclear fusion
5. Surface contamination and lattice defects - nature and practical results.
6. Differences in isotopic composition between Earth's crust and mantle.
7. Isotopic variability of Earth's water.
8. Definition and examples of isotopic fractionation.
9. Principles and approaches to radiometric dating.
10. Applications of isotope geochemistry in environmental studies.
11. The application of thermal analysis in mineralogy and related sciences.
12. Applied mineralogy of cement and concrete.
13. Basic results obtained on the groundwater filtration model. Water balance.
14. What do you understand by model calibration?
15. What types of boundary conditions can be applied to a numerical filtration model? What types under what hydrogeological conditions? Provide appropriate drawings.
16. Difference of model solution for steady and unsteady-state (transient) conditions. What additional parameters are necessary for transient simulation?
17. Types of model grids. MODFLOW 3-D grid and model parameters.
18. Soil degradation processes (natural vs anthropogenic).
19. Methods for determining the mobility and bioavailability of metallic elements in environmental samples.
20. Methods for identifying metallic pollutants in environmental samples.
21. Factors determining the mobility of metallic elements in environmental samples.
22. For what purpose do we study industrial waste?
23. The theoretical basics of seismic method.
24. Reflection and refraction methods in seismic (Seismic hodographs equations and graphs).
25. Well resistivity logs and ground resistivity methods.
26. Well Self - Potential (SP) logs ang ground SP methods.
27. Natural gamma profiling.
28. Bragg’s law and it’s application in qualitative phase analysis
29. Classification of clay minerals
30. Analytical techniques of clays and clay minerals
31. Heavy mineral separation methods
32. Discrimination od clay minerals using X-ray diffractometer

33. Name three mechanisms of dynamic recrystallisation.Answer: bulging, subgrain rotation rerystallization, grain boundary migration recrystallization.
34. Name the mechanism of recrystallization that occur after deformation has ceased. Answer: static recrystallization.
35. Name the type of quartz scatter visible on the diagram. Answer: I Type crossed girdles



36. Determine the sense of non-coaxial shear visible on the microphotograph. answer: sinistral sense of shear



37. Name the process responsible for the formation of the microstructure visible on the microphotograph
38. What controls the magnitude of porosity?

39. Characterize the water-bearing capacity of rocks.
40. Describe methods for assessment of renewable groundwater resources based on water table fluctuation
41. Characterize hydrodynamic and recession coefficient methods
42. Write the Dupuit formula used to calculate the well discharge at steady filtration for confined aquifer.
43. Environmental management system based on ISO 14001 and EMAS
44. How to write an environmental policy?
45. Eco-labelling
46. List water quality parameters (divided into physical, chemical and biological parameters).
47. What are the ways to get water samples from different types of water (surface e.g. ponds, rivers; groundwater).
48. How can we collect soil samples?
49. Granites - geology, mineralogy and economic significance based on examples from Lower Silesia.
50. Basalts - geology, mineralogy and economic significance based on examples from Lower Silesia.
51. The main types of volcanoes and styles of their eruptions.
52. Volcanic hazards.
53. Volcanic supereruptions and their influence on Earth's climate.
54. Principal types of landforms and their representation on a contoured topographic map.
55. Kinematic types of tectonic faults
56. Geometry of outcrop zones of layered rock formations on topographic surfaces: their dependence on the geological structural style of a given area and its topography)
57. Differences between a syncline and an anticline and between a synform and an antiform.
58. Natural disasters: examples; the criteria which determine when we are dealing with a disaster; risk of appearance of natural disasters.
59. List types of floods and describe causes and typical features of each of them.
60. List causes of earthquakes Describe the symptoms that may indicate the arrival of the earthquake
61. List the causes of landslides, where they occur and how to minimize their occurrence.
62. Characterize the methods of monitoring volcanic activity.
63. Origin of lakes and genetic types and their features; an example of lakes.
64. Morphometry, parameters of lake basins, zones of lake basins.
65. The importance of physicochemical factors in lakes: Lake water temperature, spring and autumn water mixing, optical properties of water. Variability of oxygen conditions in lakes, the importance of thermal stratification. $CO_2/HCO^{3-}/CO_3^{-2}$ chemical equilibrium as pH buffering system. Biogeochemical circulation of phosphorus, nitrogen.
66. Aquatic organisms, their role and interactions with hydrochemical factors: food web and their functional importance, algal biomass and abundance versus chemical conditions.

67. Indicators of susceptibility to degradation, trophic index by Carlson. Eutrophication, causes, consequences.
68. Waster management: hierarchy of waste management, waste codes, waste disposal – advantages and disadvantages; construction, sealing and operation of landfills; thermal waste utilisation incineration: advantages and disadvantages, process; composting -advantages and disadvantages, conditions during processing the waste, technologies.
69. Water production: purposes of water production versus its parameters, types water uptakes, the typical process of water treatment for drinking purposes: infiltration ponds, iron removal (aeration), coagulation, sand filtration, ozonation, active carbon adsorption, disinfection.
70. Wastewater treatment: purposes, technologies of domestic wastewater treatment: mechanical, chemical, biological part – process operation and devices. Sewage sludge management: fermentation, biogas usage, sludge dewatering and utilisation methods.
71. Lithostratigraphic classification – definitions of classification and unit, kinds and naming of lithostratigraphic units
72. Biostratigraphic classification – definition of classification and unit, kinds and naming of biozones
73. Differences between chronostratigraphic classification and geochronological scale – definitions and kinds of chronostratigraphic and geochronological units
74. Methods of stratigraphic correlation (lithological and age correlation); index fossils
75. Taphonomy – examples of Fossil-Lagerstätten, depositional environment (preconditions)
76. Physical and chemical properties of groundwater
77. Chemical components of groundwater and their origin
78. Methods of presenting the chemical composition of groundwater
79. Groundwater quality assessment
80. Hydrogeochemical background - determination methods
81. What type of contaminants are recognised to be the main problem of atmospheric pollution?
82. Give 5 examples of anthropogenic sources of contaminants.
83. What analytical methods can be useful for specific types of contaminants?
84. Water and soil remediation techniques.
85. Describe sampling error and human error and its consequences on analytical results.
86. Lithostratigraphic classification – definitions of classification and unit, kinds and naming of lithostratigraphic units
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89. Methods of stratigraphic correlation (lithological and age correlation); index fossils

90. Taphonomy – examples of Fossil-Lagerstätten, depositional environment (preconditions)