THE UNIVERSITY OF ZAMBIA

SCHOOL OF MINES

DEPARTMENT OF GEOLOGY

GGY 3051 TEST 1 15th June, 2021. Please do not plagiarise.

Submit to: godfreymbomena@yahoo.ca

Time allowed including submission: 2h:45mins. Attempt all questions. Total Marks: 60

Section A: 20 multiple choice questions

1. **Igneous rocks can form either within the earth's crust or on the surface of the earth**
   a) True
   b) False

2. **What happens when the confining stress on a rock is greater than the unconfined compressive stress (UCS)?**
   a) Nothing
   b) There will be brittle, catastrophic failure
   c) Under these circumstances, ductile failure starts
   d) All of the above
3. **Which statement is true?**
   a) The presence of water and any increased pore pressure significantly reduce rock strength
   b) Pore pressure acts in opposition to confining stress
   c) Saturation slightly reduces the internal angle of friction and greatly reduces apparent cohesion
   d) All of the above
4. **Plasticity and properties of clay soils depend on the amount and type of clay minerals**
   a) True
   b) False
5. **Igneous rocks do not make good foundation rocks because they easily undergo dissolution**
   a) True
   b) False
6. **Which statement is correct?**
   a) In a normal fault, compressive stresses result in the hangingwall side moving upwards
   b) In a reverse fault, compressive stresses result in the hangingwall side moving downwards
   c) In a normal fault, tensional stresses result in the hangingwall side moving upwards
   d) In a normal fault, tensional stresses result in the hangingwall side moving downwards
7. **Compressional stresses in rocks result in**
   a) Lengthening strain

b) Tensile failure
c) Normal faults
d) Shortening strain

8. Which statement is not correct?

a) Joints are fractures in metamorphic rocks
b) Fractures are found in sedimentary rocks
c) Faults are fractures in soft rocks
d) All of the above

9. Which of the following are all geological structures?

a) Joints, foliation, dome, bedding
b) Crack, joint, fault, foliation
c) Foliation, sedimentation, joint, bedding
d) None of the above

10. Olivines and Pyroxenes are

a) Plagioclase minerals
b) Felspathic minerals
c) Felsic minerals
d) Mafic minerals

11. What are cleavage planes?

a) Surfaces along which there are no bonds of attraction
b) Planes of symmetry in mineral's crystal structure
c) Faces in a mineral with weaker bonds of attraction along which minerals break
d) All of the above

12. Why would quartzite make a better construction material than schist?

a) Because quartzite is a metamorphic rock
b) Because schist is a sedimentary rock
c) Because Quartzite is tougher than schist
d) All of the above

13. In which soils would you expect to have subsidence on road surfaces with time?

a) Expansive soils
b) Cohesionless soils
c) Shrinking soils
d) Cohesive soils

14. Which statement is correct?

a) A structural dome is anticlinal in nature with older rocks in the middle
b) A structural valley is synclinal in nature with younger rocks in the middle
c) A structural dome is anticlinal with younger rocks on the outside/margins
d) All of the above

15. Which statement is true?

a) Layering is a secondary structure in igneous rocks
b) Minerals of the same chemical composition will always have the same colour
c) Foliation is a primary structure in metamorphic rocks

d) None of the above

16. **Which statement is correct?**
    a) Sand has some induced cohesion when it is slightly moist
    b) Uncemented gravels are cohesionless soils
    c) Clays are cohesive soils because of the strong forces of attraction between soil particles
    d) All of the above
17. **A soil's bearing capacity**
    a) Is higher in transported soils
    b) Is lower in less porous rocks
    c) Is higher in saturated soils
    d) Is higher in dense soils
18. **Which of the following rocks are examples of sedimentary rocks?**
    a) Sandstone, Siltstone, Conglomerate, dolomite
    b) Sandstone, Mudstone, Siltstone, Conglomerate
    c) Limestone, Dolomite, granite, sandstone
    d) Schist, sandstone, limestone, mudstone
19. **Which of the following is true?**
    a) Joints are fracture that are filled with recrystalised minerals
    b) Undulations or bends in rocks are called faults
    c) Folding happens when brittle rocks are exposed to compressive stresses
    d) In faulting, one block of rock moves relative to the other
20. **Piled foundations are desirable**
    a) When sediment cover is thick
    b) For masonry 3 structures when sub-surface soils and rock are strongly weathered
    c) When proposing to construct single story residential houses
    d) When building in a mountainous region

Section B: Two Questions. Attempt both

Question 2 (20 marks)

a) (i) Weathering of soils and rocks is undesirable in structural engineering. What is weathering, and up to what depth in the subsurface would you expect engineering materials to be weathered?……. (3 marks)

(ii) List and explain any three types of weathering that are there…… (3 marks)

(iii) What factors promote/influence the depth of weathering?…… (2 marks)

(iv) What is an "***Engineering soil***" and what would its rippability be expected to be?..... (3 marks)

(v) Why is it important to consider how weathering can affect structural engineering works in a given environment?..... (3 marks)

b) (i) Erosion is undesirable in coastal engineering. What is the dominant mechanism that drives coastal erosion and deposition?..... (2 marks)

(ii) What are some dangers of building on a coastal cliff?..... (2 marks)

(iii) How can the safety of an oceanic coast be enhanced?..... (2 marks)

Question 3 (20 marks)

a) (i) Different rocks have different strength parameters. What does the strength of any intact rock ***depend*** on?..... (2 marks)

(ii) What ***influences*** the strength of rock masses?..... (2 marks)

(iii) What two components enhance the shear strength of soils/rocks? Explain how they do so.....(2 marks)

(iv) As a project engineer, how can you improve the ground conditions of a site before putting up your foundation?..... (2 marks)

(v) What are some dangers of putting deep piled foundations in a limestone?..... (2 marks)

b) Following tests on an engineering soil, the following geotechnical factors are provided:

Shear stress τ (KPa)	20	35	50	65	80	95
Normal stress (KPa)	30	70	110	150	190	230

(i) Calculate/find the cohesion (c') of this soil, if it has any.....(5 marks)

(ii) Calculate the internal angle of friction (ϕ) for this soil, if it has any..... (5 marks)

End……