THE UNIVE RSITY OF ZAMBIA
SCHOOL OF MINES

GGY3051
ENGINEERING GEOLOGY
(THEORY QUESTIONS)

INSTRUCTIONS:	**THIS PAPER IS DIVIDED INTO TWO SECTIONS**
SECTION A [25 MULTIPLE CHOICE QUESTIONS] -	**EACH QUESTION CARRIES TWO [2] MARKS** **ANSWER ALL QUESTIONS BY CIRCLING THE CORRECT CHOICE.** **IF YOU DO NOT KNOW THE ANSWER CIRCLE THE CHOICE 'E'.** **A WRONG CHOICE WILL BE MARKED OUT OF NEGATIVE ONE [-1]**
SECTION B -	**ANSWER 2 QUESTIONS [50 MARKS]**

SECTION A:

A1. Which one of the following is not characteristic of a mineral?
A. Made of an element or chemical compound
B. Definitive physical composition
C. Orderly, regular repeating internal atomic arrangement and crystalline structure
D. Is made of inorganic solids
E. I do not know

A2 Which one of the following is a geological engineering problem?
A. Steep slopes
B. Cut-slopes
C. Stable slopes
D. Cliffs
E. I do not know

A3. Which one among the following is not a silicate mineral?
A. Plagioclase feldspar
B. Pyroxene
C. Pyrite
D. Quartz
E. I do not know

A4 Which one of the following is not true about the occurrence of silicate minerals
A. Single chains
B. Independent octahedra
C. double chains
D. Sheets
E. I do not know

A5 In the cycle of continuos interatction among the earth's shpears, which one of the following is the odd one out.
A. Turbidity
B. Soil loading
C. Deforestation
D. Percollation
E. I do not know

A6 Which one of the following best described interaction between Bioshphere – Hydroshpere – Litho and Lithoshpere?

A. Turbidity
B. Soil loading by erosion in water
C. Deforestation
D. Slope failure
E. I do not know

A7. Igneous rocks originate from solidification of molten magma. Which one of the following terms is not associated with igneous rocks?

A Foliation
B. Intrusive
C Extrusive
D. Dyke
E. I do not know

A8 The earth's system's processes are driven by:

A. Oocean circulation & erosional processes.
B. Earth's internal and external processes
C. Volcanoes and earthquakes
D. Heat from the sun and earth's interior
E. I do not know

A9. Discontinuities/ fractures along which there has been relative movement/displacement of blocks area called?

A. Folds
B. Faults
C Joint
D. Intrusions
E. I do not know

A10 Which one of the folowing is correct?

A. The earth's crust is also know as the lithospere
B The Asthenoshpere is the thickest physical layer of the earth
C The continental crust is thiner than the oceanic crust
D. The earth's structure is divided into physical and chemical layers of the same thicknesses
E. I do not know

A11 Which of the following rock types is widely associated with stratification?

A. Igneous rocks
B. Fossil rocks
C. Metamorphic rocks
D Sedimentary rocks
E. I do not know

A12 Engineering design on or in rock MUST be based on Intact rock properties and rock mass rock mass properties. Sate True or False

A. TRUE
B. FALSE
C I do not know

A13 Which one of the followig is not true

A. Discontinuities cause blocks of rocks to have significantly different physical props from intact rock samples of the same rock
B. Discontinuities are the biggest factor in determining anisotrophy in rocks. True or False
C. Presence of discontinuities in rock mass is the primary controlling factor of rock mass strength and deformability
D. Physical properties of Intact rock have a greater influence on engineering properties of rock mass than discontinuities
E. I do not know

A14 Divergent and convergent plate boundaries are commonly associated with dip-slip fault movement. True or False

A. TRUE
B. FALSE
C I do not know

A15 Which one of the following is not one of the major types of discontinuities?

A. Joint
B. Bedding plane
C. Strike line
D. Lithospheric plate boundary
E. I do not know

A16 Which one of the following is not a constructive process in nature?

A. Volcanic activity
B. Movement of chunks of land at faults
C. Folding at convergent plate boundaries
D. Soil erosion
E. I do not know

A17 Factors involved in consideration of surface characteristics of discontinuities for strength include one of the following:

A. Strike
B. Roughness
C. Colour
D. Dip
E. I do not know

A18 Most volcanoes and earthquakes are found at edges of convergent and divergent plate boundaries. State True of False

A. TRUE
B. FALSE
C I do not know

A19 In engineering geology why is emphasis placed on rock mass strength more than intact rock strength?

A. Intact rock strength tends to be greater than rock mass strength
B. Engineering works are built on ground masses, and it is the reaction of the mass which must be calculated or designed for.
C. Rock mass strength tends to be greater than intact rock strength
D. A and C are both correct
E. I do not know

A20 Intact rock strength must be studied in the context of it's contribution to mass strength. True or False

A. TRUE
B. FALSE
C I do not know

A21 Which one of the following statements is not true?

A. Compressive forces cause faulting and folding
B. Tensional forces cause thining of crust and faulting
C. Shearing forces cause shearing and faulting
D. Compressive, tensional and shearing forces cause folding
E. I do not know

A22 Evaluation of engineering properties of rock mass includes:

A. Knowledge of intact rock props
B. Occurrence & nature of discontinuities
C. Extent of weathering
D. A, B, C are all correct
E. I do not know

A23 The shear strength of a discontinuous rockmass ismore important than the intact rock strength of its sample specimens. True or False

A. TRUE
B. FALSE
C I do not know

A24. Chose the correct statement

A. A reverse fault is a fault generally steeply inclined, along which hanging-wall block has moved relatively downward

B. A normal fault is a fault generally steeply inclined, along which hanging-wall block has moved relatively upward

C. In a reverse fault forces compress

D. In a normal fault forces compress

E. I do not know

A25 Which one of the following is not true?

A. Chemical weathering weakens all rocks by altering their engineering properties

B. The presence of discontinuities controls the strength and deformability of rock masses and susceptibility to chemical weathering.

C. Presence of intersecting discontinuity-sets greatly reduces intact rock strength compared to that of rock masses

D. A, B and C are all not true

E. I do not know

A26. Which one of the following constitutes a set of igneous industrial minerals?

A. Nepheline, Mica, Feldspar, Lithium minerals

B. Vermiculite, Talc, Graphite, Asbestos

C. Beryl, Nitrates, Lignites, Diamond

D. Borate, Potash minerals, Sodium minerals, Nitrates,

E. I do not know

A27. Rolled asphalt and Mastic Asphalt are two major types of Asphalt used in construction. Different types of Rolled Asphalt are distinguished according to:

A. Temperature at which the Asphalt is produced

B. Binding process between asphalt and aggregate

C. Durability of the asphalt

D. Bitumen content

E. I do not know

A28 A block of granite of weight 5000kN rests on a 30^{o} rock slope with a base area of $100m^{2}$. What is the ratio of the Normal Stress to Shear

A. 4

B. 2

C. 6

D. 1

E. I do not know

A29. What kind of tectonic plate boundary resulted in the formation of the East African Rift Valley?

A. Divergent Plate boundary

B. Convergent Plate boundary

C. Transform Plate boundary

D. Convergent and Transform Plate Boundary

E. I do not know

A30. The features we see on Earth's surface represent a dynamic balance between constructive and destructive processes.

Mountain building is A major destructive process. Sate True or False.

A. TRUE

B. FALSE

C I do not know

A31. The three activities that promote mountain building are:

A. Folding, Faulting and Volcanic Activity

B. Earthquakes, Faulting and Folding

C. Volcanic activity, Folding and Erosion

D. Faulting, Erosion and Earthquakes

E. I do not know

A32. Which one of the following is not correct?:

A. Dip direction is the direction of the downward slope

B. Dip direction is different from dip angle

C. Strike and dip directions are perpendicular to each other.

D. A joint plane with a dip angle of 40° and a strike angle of 70° is written as $70^{O}/40^{o}$

E. I do not know

A33. Weathering, is a major constructive process, which is promoted by continuous physical chemical events that cause land and rocks to wear down. State True of False

A. TRUE
B. FALSE
E. I do not know

A34. Which one of the following is not part of the vadose zone?

A. capillary zone.
B. soil-water zone
C. intermediate-vadose zone
D. zone of saturation
E. I do not know

A35. The quantity of groundwater that can be stored depends on

A. Permeability
B. Infiltration
C. Porosity
D. Percolation
E. I do not know

A36. Faulting is generally relatively less dangerous than folding at dam sites. State True or False

A TRUE
B. FALSE
C. I do not know

A37 which one of the following is bnot true

A Open folds have limbs that have a gentle slope
B Isoclinal folds have limbs that are perpendicular to one another
C Overturned folds – have limbs that dip in same direction
D Recumbent folds – have limbs that are horizontal
E I do not know

SECTION B:

B1.

i What kind of discontinuity is a rock joint?

ii Mention three ways/processes by which rock joints can form in nature.

iii Joint distribution or spacing and orientation are some of the critical factors that contribute to strength of rock mass. Mention four factors that could reduce the friction along joints on a slope that is subjected to engineering processes/loading.

iv What is a group of joints that are parallel to each other called? Mention one remedial measure that can be taken to stabilise such joints on a rock slope.

v What is the fifference between a fault and ajoint?

B2.

A fault plane is inclined 40^{o} with respect to the horizontal. A block of rock is imposing a vertical force of 60kN to the fault plane.

(a) Sketch the arrangement of the forces in relation to the fault plane

(b) Assuming the forces are acting on the fault plane of area 0.5 m^2, determine the normal and shear stresses

(c) Is the block of rock, lying on top of the fault plane, likely to slide?. Explain your answer.

B3.

i Mention three types of slope failures

ii Explain the conditions under which wedge-type slope failures occur

iii Mention any two types of slope failures in unconsolidated soil masses

B4

i What is the hydroglogical cyle

ii Explain the key components of the hydrological cycle

iii Mention five land-use activities commonly responsible for groundwater pollution in the Urban areas.

iv Mention four ways in which the quality of groundwater resources can be safeguarded