



UNIVERSITY
OF
JOHANNESBURG

<u>FACULTY</u>	: Science
<u>DEPARTMENT</u>	: Geology
<u>CAMPUS</u>	: DFC
<u>MODULE</u>	: GLGE2A2 (ENGINEERING GEOLOGY 1B) (MINING)
<u>SEMESTER</u>	: First
<u>EXAM</u>	: 3 June 2021

<u>DATE</u>	:	3 June 2021	<u>SESSION</u>	:	12:30-15:30
<u>ASSESSOR(S)</u>	:	Mr. F.E.D. SENZANI			
<u>MODERATOR</u>	:	Dr. D.H. ROSE			
<u>DURATION</u>	:	3 HOURS	<u>MARKS</u>	:	170

NUMBER OF PAGES: 23 PAGES

STUDENT NUMBER	
STUDENT INITIALS	
STUDENT SURNAME	
STUDENT SERIAL NUMBER (SEE REGISTER)	

INSTRUCTIONS:

1. Using the table on Page 11, answer **ALL THE QUESTIONS** in **Sections A and B**. Answer **any four** in **Section C**.
2. Numbered spaces in this document must be used to answer the questions. Request additional paper if you need additional space.
3. **Submit all of this document**

SECTION A – TRUE OR FALSE QUESTIONS
INSTRUCTIONS FOR SECTION A ONLY

- (i) **Write the full word "TRUE" OR "FALSE" in the right space in the table on page 11. Do not use "T" OR "F" instead.**
- (ii) **Each question carries a 0.5 mark, with the total for the section being 30 marks.**
- (1) Where tectonic plates converge, reverse faulting is dominant, over other faulting styles. **TRUE**
- (2) Seismic studies were used to determine the layering of the solid earth. **TRUE**
- (3) The Earth's compressive earthquake waves travel through both fluid and solid media. **TRUE**
- (4) Fossils help determine primarily the absolute ages of rocks. **FALSE**
- (5) Quartz is a member of the feldspar family of minerals. **FALSE**
- (6) Rock forming minerals are produced during heating up of a body of magma. **FALSE**
- (7) The regular structure of atoms in a mineral is known as the crystal shape. **FALSE**
- (8) Gabbros are igneous rocks, in which alkali feldspar and quartz, occur as essential minerals. **FALSE**
- (9) Igneous rocks formed at great depth in the crust, are coarse grained. **TRUE**
- (10) When the temperature of the magma falls slowly, it begins to crystallise different minerals in any order. **FALSE**
- (11) The early minerals to crystallise out of magma are more femic than those that form later. **TRUE**
- (12) Igneous rocks are extrusive when the magma is forced out and cools rapidly on the surface of the earth. **TRUE**
- (13) Lignite is the lowest grade of coal. **TRUE**
- (14) Calcrete is an example of an evaporitic sedimentary rock. **TRUE**
- (15) During diagenesis, sediment changes into a rock through increase in density, cohesion and porosity. **FALSE**
- (16) Gneissic rocks form at very high temperatures and relatively low pressure. **FALSE**
- (17) Migmatite is produced, after felsic minerals have melted, while mafic minerals remain solid in the same rock. **TRUE**
- (18) A quartz-rich sandstone, when thermally metamorphosed, forms quartzite. **TRUE**

- (19) Large ironstones and manganese deposits are hosted by the Transvaal Supergroup. *TRUE*
- (20) The Witwatersrand Supergroup hosts coal as well as gold. *FALSE*
- (21) The Rustenburg Layered Suite forms part of the Bushveld Complex. *TRUE*
- (22) The Ventersdorp Supergroup is composed mainly of basalt and andesite. *TRUE*
- (23) Pisolites are nodular rocks, formed by precipitation of carbonate, on the seafloor. *TRUE*
- (24) An ore mineral is a naturally occurring metal or mineral from which only one metal can be extracted economically. *FALSE*
- (25) Residual, placer, and chemically formed deposits are some of the deposits falling under the group 'secondary ore deposits'. *TRUE*
- (26) Temperature, pressure and water are the agents that bring about the metamorphism of rocks. *TRUE*
- (27) Salt (halite) is commercially exploited from evaporite deposits. *TRUE*
- (28) Important placer deposits of diamonds are found along the present and old course of the Vaal River. *TRUE*
- (29) There are three types of early magmatic deposits, namely disseminations, segregations and injections. *TRUE*
- (30) Volcanogenic massive sulphide deposits consist of accumulations of sulphide minerals that are usually less than 60% sulphides. *FALSE*
- (31) High temperature hydrothermal deposits (hypothermal) form furthest from the intrusion. *FALSE*
- (32) Secondary ore deposits are concentrated by various surface processes such as weathering or alteration. *TRUE*
- (33) Gravity is not the main force causing ground water to flow. *FALSE*
- (34) When water seeps out of a rock onto the surface due to an underlying impermeable rock layer, the spring is known as a "valley spring". *FALSE*
- (35) The volume percentage of intergranular space in a rock is known as the rock's "permeability". *FALSE*
- (36) Aquifers do not permit the flow of water but aquicludes do. *FALSE*
- (37) For the same rock, the compressive strength will be higher than the tensile strength. *TRUE*
- (38) The type of cement has no impact on the strength of a rock while the amount does. *FALSE*
- (39) A coarse-grain granite is a stronger rock than a conglomerate of the same grain size. *TRUE*
- (40) As progressively greater pressure is applied to rock material, the maximum compressive stress before the rock fails is known as its compressive strength. *TRUE*

- (41) When discontinuities are widely separated, the strength of intact rock material controls the potential for failure. *TRUE*
- (42) Only the Bieniawski system of rock mass characterization, utilizes rock quality designation (RQD), while Barton's system does not. *FALSE*
- (43) Rock mass is the term used to describe the intact rock between discontinuities. *FALSE*
- (44) Some rock mass rating systems do not use the strength of the rock material. *FALSE*
- (45) The type of fracture filling influences a rock mass' mechanical strength. *TRUE*
- (46) Where the dip of discontinuities is from the wall into the excavation, the wall of the excavation is unstable. *TRUE*
- (47) Tunnels driven along the axis of a jointed syncline will have more stable side walls than those driven along an anticlinal axis. *FALSE*
- (48) Overbreak is typical of tunnel roof failure in thinly layered rocks. *TRUE*
- (49) For the deposition of the gold in the Witwatersrand Supergroup, a hydrothermal origin is preferred over other models. *FALSE*
- (50) Gold hosted by the Transvaal Supergroup occurs in reef or tabular form although it is of hydrothermal origin. *TRUE*
- (51) The base metal deposits at Aggeney's in the Northern Cape Province are important sources of platinum-group-metals (PGMs). *FALSE*
- (52) South Africa is the largest producer of platinum-group elements in the world. *TRUE*
- (53) Northern hemisphere coal was formed under climatic conditions that were warmer than those that prevailed in the southern hemisphere. *TRUE*
- (54) Diamondiferous kimberlite is likely to have a higher per carat value of the precious stones when compared with coastal gravels deposits. *FALSE*
- (55) Copper ore is often associated with ores of nickel, lead, zinc, molybdenum and gold. *TRUE*
- (56) Magnetic separation is used in the concentrating of chromite ore. *FALSE*
- (57) Cross-joints run at right angles to the axial plane and axis of a fold. *TRUE*
- (58) Natural exposures of rocks are known as outcrops. *TRUE*
- (59) While normal faults have a heave component, reverse faults do not. *FALSE*
- (60) In a strike-slip fault, the footwall moves downwards along the fault-plane. *FALSE*

SECTION B – MULTIPLE CHOICE QUESTIONS

INSTRUCTIONS FOR SECTION B ONLY

- (i) **Select the correct answer, and enter your response in the table on page 11**
- (ii) **There is only one correct or best answer for each question.**
- (iii) **Each question carries 1 mark, total 40 marks**

- (61) The mantle of the earth is rich in
- (A) silicon and oxygen.
 - (B) magnesium and iron. ✓
 - (C) iron and nickel.
 - (D) aluminium and silicon.
 - (E) none of the above.
- (62) The margins of a tectonic plate may be
- (A) zones of extension.
 - (B) zones of shear.
 - (C) zones of collision.
 - (D) all of the above. ✓
 - (E) none of the above.
- (63) Parts of the Earth's lithosphere are known as tectonic
- (A) segments.
 - (B) sectors.
 - (C) plates. ✓
 - (D) portions.
 - (E) none of the above.
- (64) A rock-forming mineral is a solid earth substance which
- (A) is a naturally occurring.
 - (B) has a definite chemical composition.
 - (C) has an orderly and repetitive pattern in the locations of its constituent atoms.
 - (D) all of the above. ✓
 - (E) none of the above.
- (65) Any one of the following physical properties is adequate, alone, to identify any mineral:
- (A) colour.
 - (B) form.
 - (C) cleavage.
 - (D) all of the above.
 - (E) none of the above. ✓
- (66) Native elements
- (A) are minerals composed of single chemical elements. ✓
 - (B) are defined by a unique chemical formula.
 - (C) are sulphides.
 - (D) are oxides and carbonates.
 - (E) are all of the above
 - (F) are none of the above

- (67) When a basic magma crystallises, the first minerals to crystallise are rich in
- (A) Fe. ✓
 - (B) SiO₂.
 - (C) Na.
 - (D) Ca. ✓
 - (E) (A and D). ✓
 - (F) (B) and (C).
- (68) Granites are coarse-grain equivalents of
- (A) basalt and dolerite.
 - (B) trachyte and syenite porphyry.
 - (C) andesite and diorite porphyry.
 - (D) rhyolite and granophyre. ✓
 - (E) none of the above.
- (69) Siltstones and mudstones are examples of
- (A) rudaceous rocks.
 - (B) arenaceous rocks.
 - (C) argillaceous rocks. ✓
 - (D) sandstones.
 - (E) all of the above
 - (F) none of the above
- (70) When ions precipitate out of water to form rocks, the rocks are said to be
- (A) pyroclastically formed.
 - (B) clastically formed.
 - (C) organically formed.
 - (D) chemically-formed. ✓
- (71) Metamorphism involves the character change in rocks due to
- (A) heat.
 - (B) pressure.
 - (C) invasion of reactive fluids.
 - (D) all of the above. ✓
 - (E) (A) and (B) only.
- (72) A metamorphic aureole is a result of
- (A) contact metamorphism. ✓
 - (B) dynamic metamorphism.
 - (C) dynamothermal metamorphism.
 - (D) diffusion of chemical substances.
 - (E) all of the above.
- (73) The heave of a fault is
- (A) the relative horizontal movement of the moving blocks. ✓
 - (B) the relative vertical movement of the moving blocks.
 - (C) the relative upward movement of the moving blocks.
 - (D) the relative downward movement of the moving blocks.
 - (E) all of the above.
 - (F) none of the above.

- (74) The axis of a fold
- (A) follows the hinge of the fold. ✓
 - (B) bisects the angle between the fold limbs.
 - (C) is a horizontal line on one of the limbs.
 - (D) is all of the above.
 - (E) is none one of the above.
- (75) These divisions of South African rocks are listed in order of decreasing age
- (A) Limpopo Metamorphic Complex, Witwatersrand Supergroup, Ventersdorp Supergroup, Swazian Erathem.
 - (B) Witwatersrand Supergroup, Ventersdorp Supergroup, Swazian Erathem, Limpopo Metamorphic Complex.
 - (C) Ventersdorp Supergroup, Swazian Erathem, Limpopo Metamorphic Complex, Witwatersrand Supergroup.
 - (D) ✓ Swazian Erathem, Limpopo Metamorphic Complex, Witwatersrand Supergroup, Ventersdorp Supergroup. ✓
 - (E) None shows the correct order.
- (76) The dominant rock types in the Bushveld Complex are
- (A) intrusive. ✓
 - (B) extrusive.
 - (C) hypabyssal.
 - (D) all of the above.
 - (E) none of the above.
- (77) Most of South Africa is covered by rocks of the
- (A) Barberton Supergroup.
 - (B) Limpopo Complex.
 - (C) Witwatersrand Supergroup.
 - (D) Karoo Supergroup. ✓
 - (E) none of the above.
- (78) Select the odd-one-out in the following list:
- (A) bauxite,
 - (B) manganese ore,
 - (C) iron-ore,
 - (D) dolomite. ✓
 - (E) laterite,
- (79) If an ore-body is viewed in plan, the direction of its longer dimension is known as its
- (A) axis.
 - (B) dip.
 - (C) plunge.
 - (D) none of the above. ✓
- (80) The process of formation of an ore deposit impacts
- (A) the size, shape and tenor of ore deposits
 - (B) the grade of the ore.
 - (C) the best recovery process of the ore.
 - (D) all of the above. ✓
 - (E) none of the above.

- (81) The largest gold deposits in South Africa are hosted by
(A) the Barberton Supergroup.
(B) the Limpopo Belt.
(C) the Transvaal Supergroup..
(D) the Bushveld Complex
(E) none of the above. ✓
- (82) In the Bushveld Complex, platinum deposits are associated with
(A) the Marginal Zone.
(B) the Critical Zone. ✓
(C) the Main zone.
(D) the Upper Zone.
- (83) Coal which formed in the southern hemisphere was deposited
(A) in valleys created by previous glaciation. ✓
(B) In low-lying, coastal areas.
(C) under tropical climatic conditions.
(D) as remains of ferns.
(E) in/during none of the above.
- (84) The main host for diamonds in South Africa, is the rock
(A) kimberlite. ✓
(B) lamphrophyre.
(C) dolerite.
(D) granophyre.
- (85) Categories of iron ore resources in South Africa include
(A) sedimentary types.
(B) magmatic types.
(C) supergene enriched types.
(D) all of the above. ✓
(E) none of the above.
- (86) The main use of manganese is
(A) as a scavenger in the smelting of iron ore.
(B) in the production of steels. ✓
(C) in the production of bronze.
(D) none of the above.
- (87) Chromite mineralisation is associated with
(A) basic and ultrabasic rocks. ✓
(B) intermediate rocks.
(C) acidic rocks.
(D) pyroclastic rocks.
(E) none of the above.
- (88) In the Bushveld Complex, vanadium resources are located
(A) within chromitite seams.
(B) within magnetitite seams. ✓
(C) within platinum reefs.
(D) none of the above.

- (89) Porosity in a sandstone depends partly on
(A) grain size distribution or sorting.
(B) the shape and arrangement of grains.
(C) the amount of cement.
(D) all of the above. ✓
(E) none of the above.
- (90) The water-bearing rocks lying below the water table constitute
(A) the saturated zone.
(B) the watertable.
(C) the aerated zone. ✓
(D) all of the above.
(E) none of the above.
- (91) As the moisture content of a rock increases, the mechanical strength of the rock
(A) decreases. ✓
(B) Increases.
(C) varies randomly.
(D) stays the same.
- (92) This list of rock cement is in decreasing order of the strength
(A) iron, silica, carbonate
(B) iron, carbonate, silica
(C) carbonate, iron, silica
(D) none of the above. ✓
- (93) This discontinuity separates sedimentary rocks in a depositional sequence
(A) a fault.
(B) joint.
(C) Bedding. ✓
(D) shear zone.
(E) none of the above.
- (94) Rock mass refers to
(A) a body of rock including its discontinuities. ✓
(B) a body of intact rock without any discontinuities.
(C) the weight of the rocks being studied.
(D) all of the above.
(E) none of the above.
- (95) These rocks are listed in the order of increasing strength:
(A) schist, shale, slate, gneiss.
(B) slate, shale, schist, gneiss.
(C) gneiss shale, slate, schist.
(D) gneiss, schist, slate, shale.
(E) none of the above. ✓

- (96) An excavation's wall will be more stable if
- (A) beds dip into the slope. ✓
 - (B) beds dip into the opening.
 - (C) beds are horizontal.
 - (D) beds are folded.
- (97) Rocks are thinly and horizontally layered, a horizontal tunnel made through them will have, primarily,
- (A) wall failure.
 - (B) roof failure. ✓
 - (C) floor failure.
 - (D) none of the above.
- (98) Rocks are thinly layered, and have jointing perpendicular to the layering. Both sets of discontinuities dip steeply. A horizontal tunnel parallel to strike will show
- (A) wall failure.
 - (B) roof failure.
 - (C) floor failure.
 - (D) (A) and (B) ✓
 - (E) all of the above.
 - (F) none of the above.
- (99) Rocks are thickly layered so that a surface excavation does not cut across discontinuities: The tunnel will be stable if
- (A) the rock has high mechanical strength. ✗
 - (B) the rocks are dry.
 - (C) the excavation slopes are gentle.
 - (D) all of the above. ✓
 - (E) none of the above.
- (100) Coal deposits in South Africa are hosted by
- (A) The Karoo Supergroup.
 - (B) The Ecca Group.
 - (C) The Beaufort Group.
 - (D) The Stormberg Group
 - (E) (A) and (B) ✓
 - (F) none of the above.