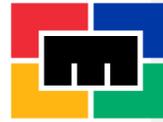


# Minerals Council South Africa



CHAMBER OF MINES OF SOUTH AFRICA



## EXAMINATION PAPER

<b>SUBJECT:</b> <u>CHAMBER OF MINES OF SOUTH AFRICA</u> CERTIFICATE IN ROCK MECHANICS PAPER 3.1 : HARD ROCK TABULAR	<b>EXAMINER:</b> JWL HANEKOM
<b>SUBJECT CODE:</b> <u>COMRMC3.1</u>	<b>MODERATOR:</b> P GREYLING
<b>EXAMINATION DATE:</b> <u>11</u> OCTOBER 2018	<b>TOTAL MARKS:</b> [105]
<b>TIME:</b> 14:30 – 17:30	<b>PASS MARK:</b> (60%)

Formatiert: Schriftart: Fett

Formatiert: Nicht Hervorheben

NUMBER OF PAGES: 4

**THIS IS NOT AN OPENBOOK EXAMINATION – ONLY REFERENCES PROVIDED ARE ALLOWED**

SPECIAL REQUIREMENTS:

1. Answer **ALL** the questions **legibly** in English and **ensure you read and execute the instructions to the candidate**.
2. Write your **ID Number** on the outside cover of each book used and on any graph paper or other loose sheets handed in.

**NB:** Your name **must not** appear on any answer book or loose sheets.

3. Show all calculations **and check calculations on which the answers are based**.
4. Hand-held electronic calculators may be used for calculations. Reference notes may not be programmed into calculators.
5. Write **legibly** in ink on the **right hand page** only – **left hand pages will not be marked**.
6. Illustrate your answers by means of sketches or diagrams wherever possible.
7. **Final answers** must be given to an accuracy which is typical of practical conditions.

**NB:** Ensure that the correct unit of measure (SI unit) are recorded as marks will be deducted from answers if the incorrect unit is used even if the calculated value is correct.

8. In answering the questions, full advantage should be taken of your practical experience as well as data given.
9. Please note that you are not allowed to contact your examiner or moderator regarding this examination.

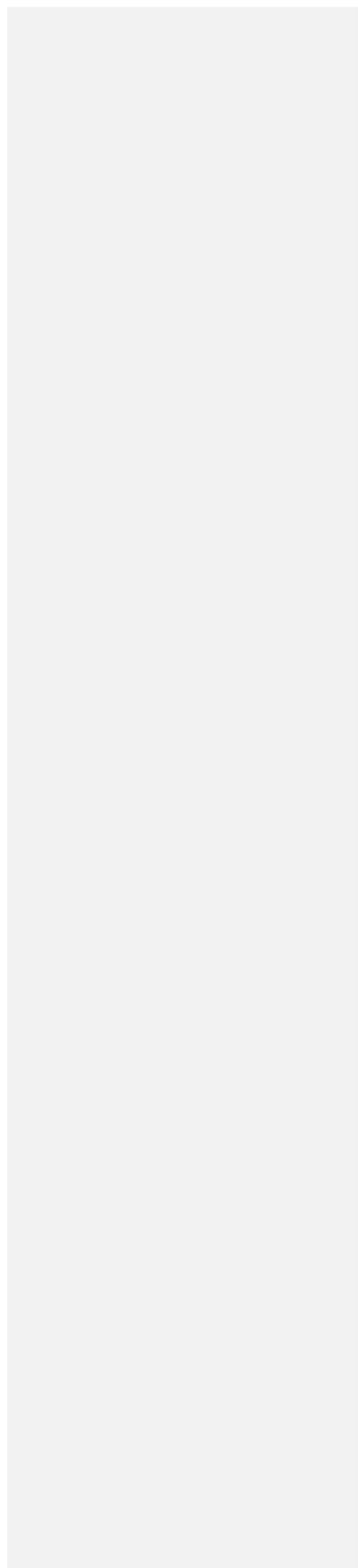
10. Cell phones are **NOT** allowed in the examination room.

### **Important instructions to the candidate**

**The following instructions to the candidate is critical to the completion of the examination and marking of scripts.**

1. The aim of the case study is to see whether you, the candidate, understand the need for, the analysis of, application of relevant data and the execution of rock engineering designs. You are requested to provide sufficient information in your responses to clearly indicate your level of knowledge and understanding. In this process. You will be required to utilise your knowledge of the theory outlined in the relevant syllabus and it should, where appropriate, form part of your response.
2. The examiner will look for reasonable relevance / appropriateness of your response to the case study conditions sketched. Make sure you indicate / explain the relevance in each response.
3. Where you believe that insufficient data is provided, you are required to make relevant assumptions based on conditions experienced on similar environments in the industry. Ensure these are appropriate to the specific Case Study environment.
4. You are requested to provide some of your feedback in table format. Where required a table format is suggested. Please re-create the table formats in your script.
5. Although the Total Marks allocated are 105, the marks earned will be reported as a percentage.

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## CASE STUDY

Resource drilling by a local company you work for has indicated the presence of a high-grade gold deposit in a certain area in South Africa. The company has requested that before any further studies are conducted, a brief rock engineering investigation into the mining of this orebody be conducted by you [self](#), their certificated Rock Engineer. They requested that you use all of your experience and knowledge of the environment sketched below (as well as of other similar environments), to answer the questions set out in this document. Your answers will assist them in preparing for any further studies to be conducted. The information currently available to you, and from which you must infer information to answer the questions, is listed below.

<b>Mining depth range</b>	Between 1500m <a href="#">bs</a> and 2000m <a href="#">bs</a> below surface.
<b>General rock mass</b>	First 600m below surface consist of sand, calcrete, shale and dolomite, followed by a succession of quartzite material until the orebody is encountered at 1500mbs.
<b>Geological structures</b>	A large number of approximately North-South striking faults with vertical throws of between 20m and 200m are present in the <a href="#">E</a> eastern part of the lease area (spaced average 100m apart). The faults are often associated with dyke material injected along the fault contacts. Towards the <a href="#">W</a> western part of the lease area, geological structures are limited to natural joints within the hangingwall, orebody and footwall material (no major faults).
<b>Orebody</b>	The orebody consists of a 5km (along strike) and 1.9km (proven) along dip, tabular, conglomerate package of approximately 50cm to 1.0m thick that dips at 15° to the <a href="#">S</a> outh. Grade distribution across the lease area as well as vertically through the orebody is relatively constant. The orebody sub-outcrops against a horizontal structure at 1500mbs and is still open at depth.
<b>Orebody hangingwall</b>	At least 900m of Bedded, mostly siliceous quartzite material.
<b>Orebody footwall</b>	Average (but highly variable) 10m thick Shale layer immediately below the reef, followed by an 100m thick, bedded argillaceous quartzite formation with alternating zones of varying strength materials. Shale is competent at exposure but degrades with time and especially if exposed to water.
<b>Topography</b>	Flat topography in a valley hosting a major river.



**QUESTION 1. GEOTECHNICAL / ROCK ENGINEERING ENVIRONMENT**

1.1 Sketch (free-hand and not-to-scale) both a plan and section view of the environment described in the case study and show all provided information by clearly annotating the sketch. Note: Show the North direction on both sketches. (6)

1.2 Using the information provided and your knowledge of other similar environments, describe and explain the geotechnical / rock engineering behaviours you would expect to occur around excavations (stopping and development) by referring to the following aspects

- Impact of depth on rock mass (2)
- Hangingwall behaviour (2)
- Footwall behaviour (2)
- Impact of structures on rock mass behaviour (2)

**Response format**

Issue	Describe	Explain
Impact of depth on rock mass		

1.3 Using the information provided and your knowledge of similar environments indicate which typical mining methods and layout(s) (method, access, on-reef layout, off-reef layout) will probably be most suitable for the provided conditions. Give reasons for your answers. (6)

**Response format**

Issue	Explain / reasons

**[20]**

**QUESTION 2. ROCK ENGINEERING DESIGN**

2.1 Using your answers on the mining environment and probable mining layouts and conditions in Question 1, list 5 rock engineering aspects you will need to design in this specific environment and explain why each design will be required (10)

**Response format**

Rock Engineering design	Explain why design is required

2.2 Provide for each of the designs listed in 2.1, an explanation of the geotechnical data to be gathered to allow meaning full execution of the designs

- What data is to be gathered (5)
- How it is to be gathered (method / process) (5)
- How this data will be used (5)

**Response format**

Rock Engineering design	Data required	How is data gathered	How is data used

2.3 Select **two** of the designs listed in 2.1

- Explain the design methodology to be applied by providing sufficient theory to indicate your understanding of the design methodology (10)
- Execute a “mock” design using appropriate (assumed) input parameters where deemed required (10)

**Response format**

Rock Engineering design	Explain methodology	Execute mock design

**[45]**

**QUESTION 3. RISK AND REMEDIAL ACTION**

3.1 Utilise your responses in the previous questions to list 10 (20)  
geotechnical / rock engineering hazards / concerns that could be  
materialise in this specific environment during mining and briefly  
describe / explain each hazard.

**Response format**

Hazard	Explain

3.2 For the hazards listed in 3.1, select 5 that can be viewed as a High (20)  
or Very High risk based on the specific conditions provided or  
assumed by yourself. For each of these selected hazards, explain  
why you deem the hazard to be of the allocated risk level and  
indicate all possible appropriate remedial action(s) available in the  
Industry to reduce each hazard's risk level to tolerable levels.

**Response format**

Hazard	Reason for high risk level	Remedial action required

[40]

**Total Marks := [105]**

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