



Chamber of Mines of South Africa

EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES CERTIFICATE IN ROCK MECHANICS:PAPER 2 SUBJECT CODE: COMRMC2 EXAMINATION DATE: 11 October 2017 TIME: 14:30 – 17:30	EXAMINER: B VAN DER KEVIE MODERATOR: P GREYLING TOTAL MARKS: [100] PASS MARK: 60%
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NUMBER OF PAGES: 12 (including 2 answer sheet)

SPECIAL REQUIREMENTS:

1. Answer all questions.
2. Write your **answers for Question 1 , 3.1 and 4.1 on the answer sheet provided** at the back of the question paper and submit this with your script.
3. **Only 1 (one) correct answer for all questions in Question 1.**
4. References other than those provided are not permitted.
5. Hand-held electronic calculators may be used.
6. Write your examination 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.

7. **Write in ink on the RIGHT HAND SIDE of the paper only (only the right hand pages will be marked).**
8. Show all calculations on which your answers are based.
9. Illustrate your answers by sketches of diagrams wherever possible.
10. In answering these questions, full advantage should be taken wherever necessary of your practical experience as well as of the data given.
11. Answers must be given to an accuracy that is typical of practical conditions.
12. Cell phones are **NOT** allowed in the examination room.

QUESTION 1

TICK THE MOST CORRECT ANSWER ON THE ATTACHED SHEET PROVIDED AND HAND IN WITH YOUR EXAM BOOK. ENSURE ID NUMBER IS ON THE SHEET.

Note: Question 1 will be marked negative, meaning for each incorrect answer a mark will be deducted from the remaining possible 75 marks. This will eliminate guessing of answers by the student. Therefore be very careful to answer only the questions you are certain about. If unsure leave the answer blank.

Only 1 (one) most correct answer for all questions in Question 1. If more than one is ticked no marks will be given

1.1 Which **one** of the following rocks are not Igneous rocks?

- a) Syenite
 - b) Gabbro
 - c) Quartzite
 - d) Kimberlite
 - e) Trachyte
- (1)

1.2 Which **one** of the following rocks are not sedimentary rocks?

- a) Mudstone
 - b) Shales
 - c) Coal
 - d) Pyroxenite
 - e) Limestone
- (1)

1.3 Which **one** of the following rocks are not Metamorphic rocks?

- a) Quartzite
- b) Norite
- c) Slate
- d) Migmatite
- e) Marble

(1)

1.4 Which **one** of the following statements is **incorrect**?

- (a) Any employer may prepare and implement a code of practice on any matter affecting the health or safety of employees and other persons who may be directly affected by activities at the mine.
- (b) An employer must prepare and implement a code of practice on any matter affecting the health or safety of employees and other persons who may be directly affected by activities at the mine if the Chief Inspector of Mines of Mines requires it.
- (c) A code of practice required by the Chief Inspector of Mines of Mines must comply with guidelines issued by the Chief Inspector of Mines of Mines and guidelines specified by the Health and safety committee.
- (d) The employer must consult with the health and safety committee on the preparation, implementation or revision of any code of practice, only if requested by the Chief Inspector of Mines.
- (e) C and D

(5)

1.5 Which **one** of the following instrument detect geological structures in the hangingwall?

- a) Closure meter
- b) Doorstopper
- c) Geophone

- d) GPR
- e) Accelerometer

(1)

1.6 Which **one** of the following statements is **incorrect** with regard to COP's?

- (a) This Mandatory Code of Practice to Combat Rockfall Accidents is drawn up in terms of the sections 9(2) and (3) of the Mine Health & Safety Act 1996 (Act 29 of 1996).
- (b) This Code of Practice may be used in an accident investigation or enquiry to ascertain compliance and also to establish whether the COP is effective and fit for purpose.
- (c) All managerial instructions, recommended procedures and standards on the relevant topics must comply with the Code of Practice and must be reviewed to establish compliance. It is the responsibility of the Mine Manager that procedures and mine standards are reviewed annually to establish compliance. The requirements drawn up in this Code of Practice represents the minimum requirements for each geotechnical area and do not preclude any person from taking or requesting further safety measures were considered necessary to make the mine a safer place.
- (d) The Mine Manager will keep the Code of Practice on file. Copies will be issued to the Health & Safety Committee. Failure by the employee to prepare and implement a COP in compliance with this guideline is a breach of the MHSA.
- (e) A procedure must be instigated by the appointed Rock Engineer to ensure that all employees are conversant with the relevant sections of the Codes of Practice, and these relevant sections will be translated into other languages as required, in consultation with the Health and Safety Committee.

(5)

1.7 What is the ideal w : h ratio of a barrier pillar ?

- a) 1:10

- b) 1:5
- c) 1:3-4
- d) 1:20
- e) 1:4

(1)

1.8 What is the most suitable mining method for a reef-body dipping at 25 degrees with a stoping width of 1.8m at shallow depth, shale in the footwall and very soft hangingwall lava. Due to the softness of the system rockbursting occur frequently and large falls of ground occur?

- a) Conventional Scattered breast mining
- b) Longwall mining
- c) Board and pillar mining
- d) Cut and fill mining
- e) Block caving

(1)

1.9 What is typical stope closure rates (mm/m face advance) for breast panel stoping in ultra deep mining depths (>3500m - B.S.)

- a) 10mm
- b) 0-5mm
- c) 6mm
- d) >30mm
- e) <20mm

(1)

- 1.10 Which **one** of the following statements is **incorrect** with regard to the mine health and safety act when a Samrass 3 form must be filled in?

ROCKBURSTS AND FALLS OF GROUND

An extensive rockburst or fall of ground causing the following damage underground

- (a) At least 15 linear metres of working face has been severely damaged and choked and will require re-establishment and re-supporting, or be abandoned;
- (b) At least 25m² of working area has been severely damaged and choked rendering support units ineffectual and will have to be re-established and re-supported or be abandoned;
- (c) At least 10 linear metres of gully has been restricted with rock clearly recently displaced from the hanging wall and gully sidewalls;
- (d) At least 10 linear metres continuous or 30 linear metres cumulative of access ways of tunnel or travelling way has been severely damaged and will require rehabilitation or be abandoned;
- (e) At least 10 m² of roof or 5m³ of rock has been displaced from the roof of the mining cavity or excavation.

(5)

- 1.11 The stope width of a reef channel is 70cm of which 50cm is external waste. What would the channel value be in g/t if the cm.g/t value is 2000.

- a) 150 g/t
- b) 60 g/t
- c) 100 g/t
- d) 42,9 g/t

(2)

1.12 What is the standard rate recommended for testing support units for quasi static loading in a press when testing elongates conditions in a press?

- (a) 300mm/min
- (b) 3m/sec
- (c) 30mm/min
- (d) 3mm/min
- (e) 2m/sec

(1)

[25]

QUESTION 2

2.1 When planning a “greenfields” mining operation for an opencast mine or underground shallow mine the Rock Mass Characterization is fundamental in the mine design. You as the onsite Rock Engineer must manage this process and write the final Conceptual Mine Design report. Before this can be done you must determine the behavior of the excavations in the rock where the mine is planned. Describe how you will go about doing the rock mass characterization in a structural and chronological process. Please make use of a numbering and bullet point system when answering this question to present it chronologically.

(20)

2.2 Name five factors that will influence the stability of an excavations in a jointed rockmass

(5)

[25]

QUESTION 3

- 3.1 Name 3 types of backfill systems and for each system give 2 pros and 2 cons.

Use the attached table 1 to answer the question.

(15)

- 3.2 List five (5) high risk factors in shallow (50m below surface) narrow reef breast mining. These factors must be typical high risk factors as being used in panel risk ratings.

(5)

- 3.3 What are the possible risks of poor face shape in shallow narrow reef mining

(5)

[25]

QUESTION 4

During shaft pillar extractions and shaft pillar design numerous limiting criteria for damage to shaft steelwork and concrete lining have been quoted and researched, in terms of induced vertical stress (σ_z^i), induced vertical strain (ϵ_z^i) and induced tilt (Tiltⁱ) :

- 4.1 Complete the attached table below for the damage criteria. (6)

Extracting a shaft pillar in ***an operating shaft*** in deep level mining requires careful planning. Briefly describe the preparation of the shaft pillar extraction under the following headings.

- 4.2 Shaft sidewall preparation and support. Give estimated distances of affected area and physical conditions to be encountered. (2)

- 4.3 Alterations required to the shaft steelwork. Describe and briefly discuss 3 methods that can be used to alter steelwork to compensate for the compression, ride and closure. (3)
- 4.4 Alterations to shaft services (pipes, cables and drain holes) that may be required for the movement in the shaft. (2)
- 4.5 How will the inner pillar surrounding the shaft barrel be extracted (mining sequence) and what support will be required. Make use of sketches showing the final inner pillar extraction with the support and pillar requirements (9)
- 4.6 Stopping of the outer pillar is done once the inner pillar is completed. What considerations must be taken into account when planning the outer pillar mining. (3)
- [25]**

TOTAL MARKS: 100

Answer sheet multiple choice (Question 1)
October 2017 Paper 2

ID Number

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	a	b	c	d	e
1.1	☐	☐	☐	☐	☐
1.2	☐	☐	☐	☐	☐
1.3	☐	☐	☐	☐	☐
1.4	☐	☐	☐	☐	☐
1.5	☐	☐	☐	☐	☐
1.6	☐	☐	☐	☐	☐
1.7	☐	☐	☐	☐	☐
1.8	☐	☐	☐	☐	☐
1.9	☐	☐	☐	☐	☐
1.10	☐	☐	☐	☐	☐
1.11	☐	☐	☐	☐	☐
1.12	☐	☐	☐	☐	☐

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Question 3.1

<i>Backfill System</i>	<i>Pros</i>	<i>Cons</i>

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Question 4.1

Type of damage	Criteria
Unspecified damage	σ_z^i
Unspecified damage, criterion not based on back analysis	ϵ_z^i Tilt ⁱ
Steelwork damage and increased shaft maintenance.	ϵ_z^i
Tensile fracture of concrete lining	ϵ_z^i
Compressive fracture of concrete lining	ϵ_z^i