



Chamber of Mines of South Africa

EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES CERTIFICATE IN ROCK MECHANICS:PAPER 2 SUBJECT CODE: COMRMC EXAMINATION DATE: 10 May 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: 11 (including answer sheet)

SPECIAL REQUIREMENTS:

1. Answer all questions.
2. Write your **answers for Question 1 , 3.1 and 3.2 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.

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 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 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.
- (d) The employer must consult with the health and safety committee on the preparation, implementation or revision of any code of practice.
- (e) The Chief Inspector of Mines of Mines must review a code of practice of a mine if requested to do so by a registered trade union with members at the mine, or a health and safety committee or a health and safety representative at the mine.

(5)

1.5 Which **one** of the following instruments measure principal stress or strain?

- a) Petro-scope
- b) Doorstopper
- c) Geophone
- d) Extensometer
- e) GPR

(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 not a breach of the MHSA.
- (e) A procedure must be instigated by the Mine Manager 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 an elastic pillar ?

- a) 10
- b) 5

- c) 3-4
- d) 15
- e) 4

(1)

1.8 What is the most suitable mining method for a reef-body dipping at 2 degrees with a stoping width of 3m at shallow depth?

- a) Scattered 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 shallow mining depths (20m- 200m - 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 10 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 20 m² of roof or 10m³ 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 3000?

- 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 static conditions in a press?

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

(e) 30mm/sec

(1)

[25]

QUESTION 2 (Mine Design, Support and instrumentation)

2.1 Name 5 failure mechanisms in opencast slopes. Use a sketch to illustrate each of the geotechnical setting of such a failure. (10)

2.2 For each of the 5 failure mechanisms give 1 critical factor promoting instability. (5)

2.3 When designing a slope for an opencast there are five main properties of an intact material that will determine the mechanical character of the slope. Name and briefly describe 5 of these properties. (10)

[25]

QUESTION 3 (Mine support and design)

3.1 Attached please find a table depicting 5 support elements. Complete the attached table using the system characteristics scale below where applicable:

Scale table

Excellent	Very good	Good	Fair	Poor	Very Poor
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Note: The estimated support costs must be the support unit cost only (excluding labour, drilling cost, grout cost or any other ancillary cost to install the unit)

(20)

3.2 On the attached graph draw in the force: deformation of the following support units using representative underground results of 4mm/day closure rates. Use a “freehand” to draw in the lines but make sure the differences in initial stiffness, yielding capacity and ultimate loads/failure loads are clearly depicted. Also ensure the different support units are clearly marked on the sheet.

1. Profile prop (180mm x1,2m)

2. Medium Duty Camlok Jack
3. 20mm End anchored Tendon
4. Ordinary minepole (180mm x1,2m)
5. 20/40 ton Rapid yielding Hydraulic Prop (RYHP)

(5)
[25]

QUESTION 4 (General)

4.1 Describe and discuss typical applications of geophones and accelerometers used for seismic monitoring. Describe each under the following headings.

- Typical uses and/or pros/cons (2)
- Approximate cost (2)
- Magnitude of events that can be recorded (2)
- Density per square kilometer (geophone) typical sensor spacing (accelerometer) (2)

4.2 Designing narrow reef stoping layouts for multi-reef mining needs careful planning to ensure stability of both reefs mined.

You are the Shaft Rock Engineer on a shallow mine consisting of two reefs with a middling of 30m and a stoping width of 1.5m for both reefs.

The Mine Manager requests you to design the stoping layout for these reefs and give mining and support layouts for subsequent and simultaneous extraction of the reefs.

Briefly describe these 2 layouts commenting on the requirements of both reefs to ensure stability. (7)

4.3 For the following 5 mining conditions draw a typical gully layout.

1. Shallow de-stressed conditions with 1m stoping width, mining against a solid abutment at the bottom with a leading gully. (1)
2. ASG in an underhand configuration in shallow to intermediate depth mining with a leading gully. (1)
3. Deep level mining where a panel mines against a solid abutment at the bottom. (1)
- 4 Describe and explain the factors that need to be considered in the placement of seismometers. (7)

Answer sheet multiple choice (Question 1)
May 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>Support Element</i>	<i>Initial stiffness</i>	<i>Yield capability</i>	<i>Energy absorption</i>	<i>Estimated unit cost R or R/m²</i>	<i>Area of application</i>
<i>Split Set/ Hydrabolt (1.8m)</i>					
<i>Fully grouted end anchored cable pre-tensioned (4m x15mm)</i>					
<i>Fully grouted Rock stud (2.2m)</i>					
<i>Thin sprayed liner (TSL) 6mm-8mm</i>					

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QUESTION 3.2

SUPPORT GRAPHS

