

CHAMBER OF MINES OF SOUTH AFRICA
WRITTEN EXAMINATION FOR THE CERTIFICATE IN ROCK MECHANICS
METALLIFEROUS OPTION

PART 3 - GENERAL

14 May 1997

EXAMINER:

Mr CAF Sweet

MODERATOR:

Mr A Naismith

Maximum time allowed 3 hours (09:00 - 12:00)

ANSWER ALL QUESTIONS

A pass mark for this paper is 60 per cent.

References are not permitted.

Hand-held electronic calculators may be used. (No pre-programming).

Put 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.

Write on one side of the paper only.

Show all calculations on which your answers are based.

In answering these questions, full advantage should be taken wherever necessary of your practical experience as well as of the data given.

Graph paper is available from the invigilator.

NOTES FOR THE CANDIDATE

Read these notes carefully before you start answering the questions.

The problems are not always stated obviously in the questions. Part of your task is to determine from the question the precise nature of the problem. There are no "clear cut" answers. The questions demand that you draw on your formal, academic knowledge and on your experience. Also the questions require you to demonstrate your ability to think your way through a problem, much as you would have to in the real-life situation. You will disadvantage yourself if you work through the answers in a haphazard and unsystematic manner. You are more likely to gain the benefit of the doubt from the examiner and moderator if you approach the problem methodically than if you were to adopt an unstructured and sloppy approach.

Use large, clear, well labelled sketches when necessary. These will aid your thinking as well as make your answer clearer to the examiner and the moderator. Minute, poorly labelled and undimensioned sketches will not have the desired effect.

QUESTION 1

The following are the dimensions of a required pump chamber in Class 2 (using the CSIR System) ground at a depth of 1 300 meters. You are required to present to management your proposal of how to excavate this safely and efficiently. Your recommendations must include:

i.	Method of Mining	10 marks
ii.	Temporary Support	10 marks
iii	Permanent Support	10 marks
TOTAL		<u>30 marks</u>

The excavation will be within the shaft pillar:

Length	:	60 m
Width	:	10 m
Height	:	7 m

QUESTION 2

This is a platinum mine on the UG2 horizon and you are the rock mechanics officer.

The proposal has been made to change the hole diameter from 32 mm to 45 mm and thereby reducing the number of holes required to be drilled in a stope. In addition, it is proposed that the hole length be increased to 1,6 m from the existing 1,35 m effective length. The stoping width is 1,6 m and there is a good footwall and hanging parting.

PART 3 - GENERAL - METALLIFEROUS

4

QUESTION 2 (Cont.)

Comment from a rock engineering viewpoint on:-

- | | | |
|----|---|---------|
| a) | effect of change in hole diameter | 5 marks |
| b) | effect of the change in hole length | 5 marks |
| c) | change in drilling efficiencies | 5 marks |
| d) | what would recommended explosives and initiation system be? | 5 marks |

TOTAL 20 marks

QUESTION 3

You have recently been appointed the rock mechanics officer on a deep gold mine on the Far West Rand. You are required to review the stope support system in the stopes following a number of serious fall of ground incidents.

Your Code of Practice for combating rockfalls should list a number of variables that must be considered when evaluating a stope support system.

- i) List and briefly discuss these variables
- ii) Discuss briefly "Control of Rockfalls"
- iii) Discuss briefly "Reduction of Rockburst Damage"

TOTAL

30 marks

QUESTION 4

You are the rock mechanics officer on a large, shallow metal mine, that has numerous faults, mining method is breast mining with scrapers. There is a thin parting occurring from 0,2 m to 0,4 m in the hanging wall which is considered to be very weak.

The stoping width is 1,25 m

Dip 20°

Panel length 35 meters

Pillars are provided at the top of the panels and are 4 x 4 m with 2 metre holings.

The mine has a major productivity drive on and one of the ways of getting better efficiencies is to reduce the workload and increase the number of blasts.

Sketch, discuss and motivate the temporary and permanent support you would apply giving spacing, density of support, dimensions and maximum distance from face after the blast.

Motivate the use of rock bolt support for this scenario.

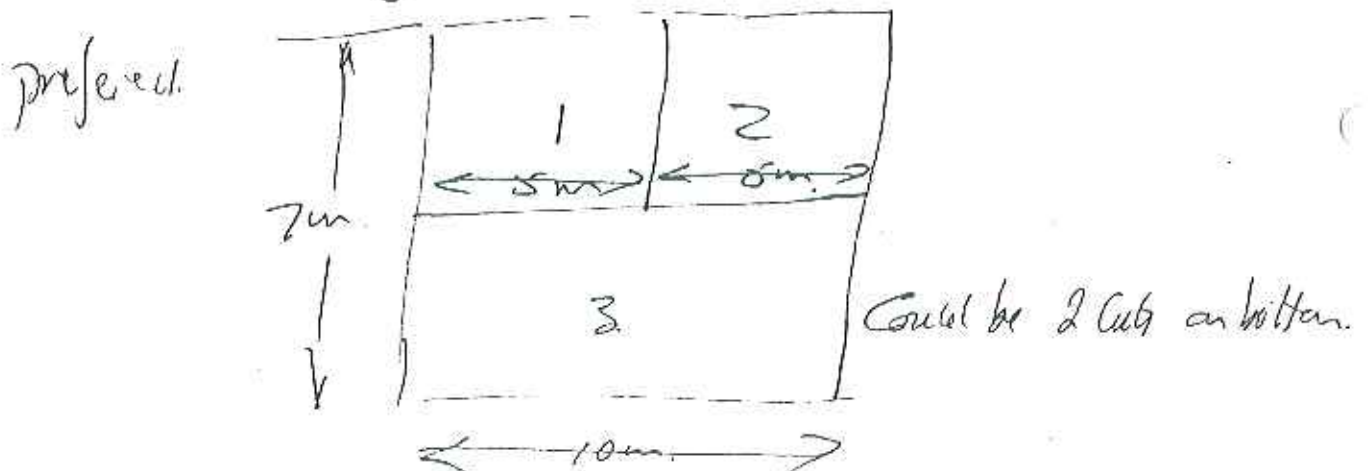
TOTAL

20 marks

⑨.

The requirements were to
 a) look at Rock mass rating (Class 2 CSIR System)
 and realise that it is "good" ground.
 b) Depth.

A number of methods would be acceptable.



1st Cut 10m ahead of 2nd.

Top Cut taken out and supported (Cement)
 bottom Cut taken out

Smooth blast all perimeter holes except 17m

Temp Support - Cantilever

- bolts (temp + permit) - installed close to face before
- w/mesh (temp) where necessary

Permanent 14/16 R/Bolts of appropriate length and space
 Carried 1st Cut not more than 4m from face
 after blast

Cable anchors of appropriate load with
 anti-screw - tensioned, grouted not more than

Q2.

Primary requirement was to see that people thought the question through - logically and gave reasonably acceptable answers, taking the time constraints into consideration

Amongst the matters requiring thought / discussion would be quantity of explosives and the charges involved taking into account the P/w e i/fw ratings

- a) hole diameter - slower drilling
- more explosives / length
 - better explosion characteristics if unfused due to larger dia
 - charge spacing
 - watch for drilling inaccuracies

- b) hole length - more effective blast
- greater P/w advance
 - consider support spacing
 - change in amount of explosives
 - drilling accuracy
 - more effective use of stop team

- c) Drilling Efficiency - time to drill larger dia
- time to drill larger hole
 - to rock
 - can cutting time
 -

- D. Explainers - answer a question
- Comment on why "stick" powder would be less effective.
 - Name.
 - Fuse e. ~~Ignite~~ Coard - slow

Q3.

Some of the points that needed to be addressed but an important aspect that was required was for the person to review slope support systems and discuss

- ①
1. Rock mass rating and/or Composition of H/W or F/W Rocks
 2. Deformation Characteristics of the support units
 3. Mining height
 4. Slope closure rate
 5. Slope closure during Rockbursts and the associated velocity of closure
 6. Spacing of slope support units
 7. Support resistance generated
 8. Ability of system to absorb energy
 9. Appropriate stiffness which will minimise damage to area immediately surrounding the support unit.
 10. Estimation of the rockfall support resistance criteria for the mining horizon
 11. Fully bolting / length / spacing etc
 12. Construction of support not to endanger people

2. Control of Rockfalls

In order to control rockfalls it is necessary to assess the fallout potential to determine the support resistance criteria that would prevent rockfalls. The % fallout that must be determined for a particular horizon and the support system must be capable of preventing at least 1% of fallout.

Training
Training

inspections
audits
Commitment
Communication.

3 Reduction of Rockburst Damage

Using statistically determined block ejection thickness it is possible to calculate a minimum energy absorber requirement in square meters of stop hangar wall.

A support system must be capable of absorbing the stop H/w for 95% of the fallout.

The velocity of ejection is assumed to be 3m/s unless verified by measurements.

Q4

Required a reasonable support layout considering

- 1) shallow mine
- 2) S/width
- 3) panel length
- 4) Crush pillars

required regional pillars

roofbolting was a guide and would have been preferred
regionally the hanging wall parting.

Top support - temp - 2 Rows mesh props or sticks
support density - pre stressed 5 to 6 m² / unit - Prefer.
- not pre stressed 3 - 4 m² / unit

max support distance from face 6m. - this being the

sticks R/bolts should be drilled on a 2x2 or similar
pattern, resin or end anchored preferably grouted is
not a necessity. no more than 1 1/2 m from face.
before blast.

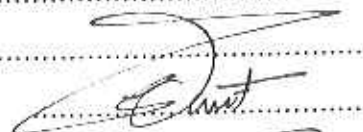
Can be answered in 1 page + drawing / sketch.

Do not want Tables, bullet points Hydraulic props

EXAMINERS COMMENTS

- QUESTION 1 what people do not seem to know what Chem 2 Group (CSIR System). Refers to - many approaches were not right
- QUESTION 2 People seem to have difficulty coming to terms with proposed changes and did not reason changes through.
- QUESTION 3 This question should all have scored high marks - people do not know or do not read relevant information.
- QUESTION 4 People did not read question or are unable to understand anything different to what is in their minds - I do not think people read their notes or can reason matters through logically.
- QUESTION 5
- QUESTION 6
- QUESTION 7
- QUESTION 8
- QUESTION 9
- QUESTION 10
- GENERAL Because of Exam time pressure persons who displayed that they thought the problem through and displayed that they were on the right track were given marks. People who went off as a tangent gained no extra marks and often lost because they wasted their own time.

SIGNATURE


C. H. F. Sweet

CHAMBER OF MINES OF SOUTH AFRICA

WRITTEN EXAMINATION FOR THE CERTIFICATE IN ROCK MECHANICS

COAL OPTION

PART 3 - GENERAL

14 May 1997

EXAMINER:

Mr JC Viljoen

MODERATOR:

Mr WA Naismith

Maximum time allowed 2½ hours (09:00 - 11:30)

ANSWER ALL QUESTIONS

A pass mark for this paper is 60 per cent.

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