



**PROGRAM** : BACCALAURIUS TECHNOLOGIAE  
MINING ENGINEERING

**SUBJECT** : MINING TECHNICAL SERVICES IVA

**CODE** : MTLA411

**DATE** : FINAL ASSESSMENT  
26 MAY 2018

**DURATION** : (SESSION 2) 12:30 - 15:30

**WEIGHT** : 60% OF FINAL MARK

**TOTAL MARKS** : 100

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**EXAMINER** : MR H STRAUSS

**MODERATOR** : MR WB MOTLHABANE

**NUMBER OF PAGES** : 7

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**INSTRUCTIONS** : ANSWER ALL QUESTIONS

**REQUIREMENTS** : INFORMATION BOOKLET (SUPPLIED BY EXAMINER)  
ONE SCRIPT (SECOND ON REQUEST)  
BOOKLETS AND GRAPHS MUST BE HANDED IN

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**INSTRUCTIONS TO CANDIDATES:**

READ THE QUESTIONS THOROUGHLY BEFORE YOU START

ANSWER ALL THE QUESTIONS

SHOW ALL CALCULATIONS AND SI UNITS (NONE SHOWN = NO MARKS)

DO NOT USE CORRECTION FLUID, A PENCIL, OR A RED PEN

HAND IN ALL YOUR WORK AS WELL AS THE BOOKLET

DO YOUR OWN WORK – EARN YOUR MARK WITH PRIDE

**QUESTION 1**

- 1.1 Write brief notes on the following heat related disorders:
- 1.1.1 Heat stroke. (3)
- 1.1.2 Heat exhaustion. (3)
- 1.2 Discuss five factors that affect the heat tolerance of a person. (10)
- 1.3 List five properties of a good refrigerant. (5)
- 1.4 List five requirements that must be met in order for stone dust to be approved (i.e. approved stone dust must: ...). (5)
- 1.5 Differentiate between a detonation and a deflagration. (4)
- [30]**

**QUESTION 2**

- 2.1 An air stream flows down a mine shaft from surface to a depth of 1 950m. Estimate the increase in sigma heat. Disregard geothermal heat sources. (3)
- 2.2 A stream of 56kg/s of ventilating air needs to be cooled from a  $t_{wb}$  of 32°C down to a  $t_{wb}$  of 18°C in an underground bulk air cooler. Given that the cooling water temperature change is 12°C, estimate the cooling water mass flow required. The barometric pressure is 105kPa. (5)
- 2.3 A dump truck with a rated output power of 170kW hauls a load of 28t along a horizontal roadway. Given that it has an overall efficiency of 28%, estimate its contribution to the heat load of the section. (4)
- 2.4 The data below reflect the results of measurements taken in the return air from a CM section. Assess the likelihood of a gas explosion. Show all calculations comprehensively as well as any graphical analysis that you may have used.
- |                   |     |
|-------------------|-----|
| % Oxygen          | 14% |
| % Methane         | 4%  |
| % Hydrogen        | 6%  |
| % Carbon monoxide | 5%  |
- (8)
- [20]**

**QUESTION 3**

- 3.1 Differentiate between the two types of rock bursts that may occur in a deep mine. Under what circumstances would you anticipate each? (4)
- 3.2 A rock burst occurs in a quartzitic rock mass of which the elastic properties are listed below:
- |                 |                        |
|-----------------|------------------------|
| Young's Modulus | 75GPa                  |
| Poisson's Ratio | 0,21                   |
| Rock density    | 2 750kg/m <sup>3</sup> |
- 3.2.1 Which are the shockwaves that are to be used to locate this event in space and time? (2)
- 3.2.2 What would their respective velocities be in this rock mass? (4)
- 3.2.3 If the arrival time difference between the two waves was recorded by a seismometer as 20 milliseconds, how far away from this instrument did the event occur? (4)
- 3.3 Differentiate between those parameters that can be directly measured and those that cannot. (2)
- 3.4 Briefly discuss the objectives of the three levels of monitoring required in an under-ground coal mine. (6)
- 3.5 Using the geotechnical data given in appendix A, determine the adjusted mining rock mass rating. (8)

**[30]****QUESTION 4**

- 4.1 You have to design a support layout for a shallow stoping operation and you have the data below at your disposal. Make recommendations regarding dip and strike spacing. Show all assumptions and calculations. (6)

Stoping width	160cm.
Dip	18°.
Support units	200kN elongates, 30cm thick. Headboards: none.
Roof detail	Jointed beam, joint density = 15joints/m. Dip of joint set = 45°. Beam thickness = 1,5m. Rock density = 3 200kg/m <sup>3</sup> . Expected failure mode – shear failure.
Friction angle on all planes	38°
Panel length	32m
Level spacing	50m

- 4.2 Making use of a neatly labelled sketch, describe three characteristics of support that may be determined during a support test procedure. (3)

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- 4.3 You are required to design a support layout for a CM section with a road width of 6,4m. The immediate roof is composed of a 50cm layer of weakly bonded laminations with a thickness of 20mm. This layer is overlain by a sandstone layer that is 90cm thick.

You will be using resin point anchors of 20mm diameter, installed in 28mm diameter holes. The shear resistance of the resin is 2,1MPa, and the rebar yield strength is 590MPa.

Make recommendations regarding row and bolt spacing. Show all calculations and assumptions.

(11)

**[20]**

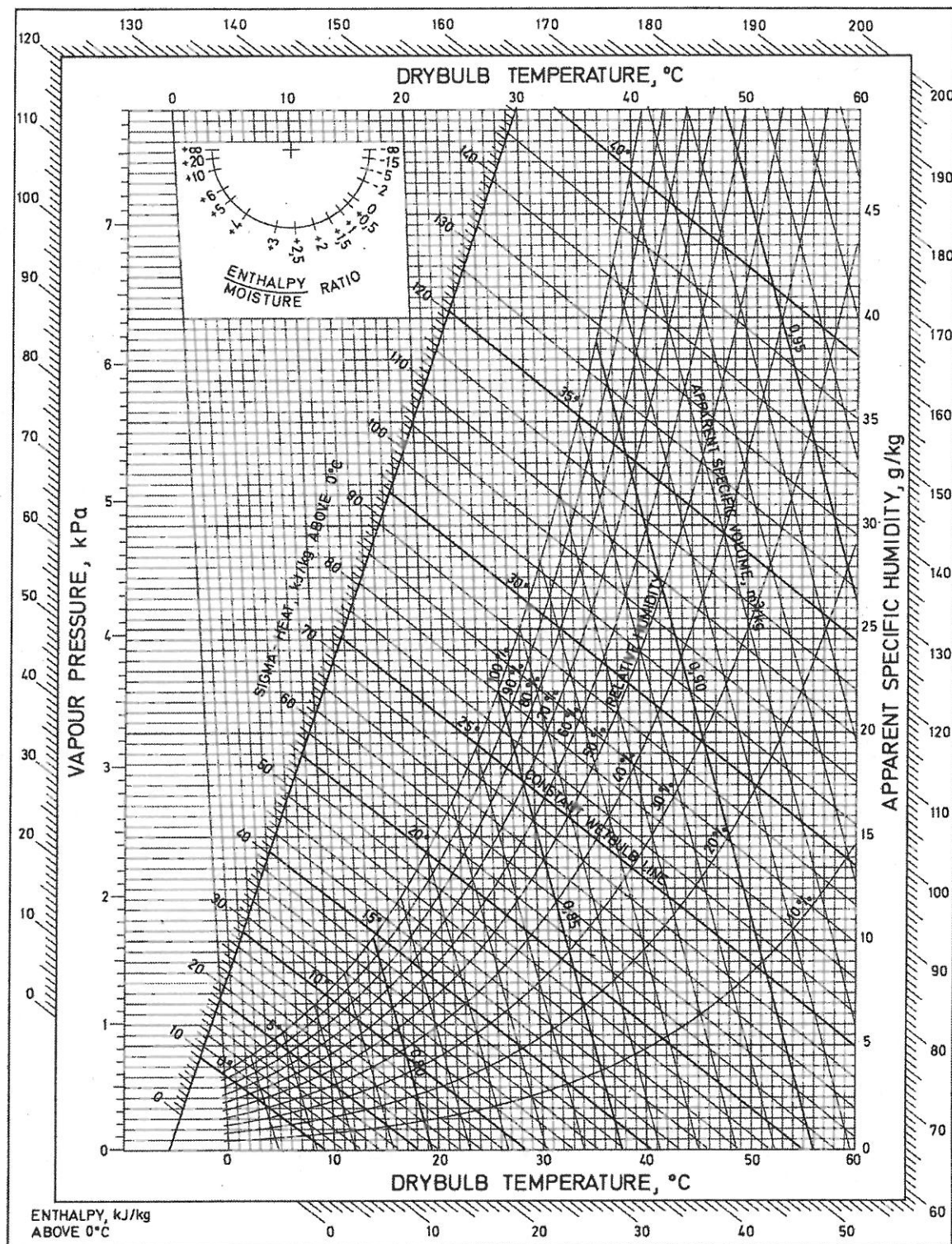
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**TOTAL**

**[100]**

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105,0 kPa



**Appendix A**

RQD	Total length of core >100mm = 795m Total length of core run = 1340m
UCS	190MPa
Ground water	60 l/min
Number of joint sets	2
Large scale joint expression	Straight
Small scale joint expression	Striated
Joint wall alteration	Weaker than wall rock
Joint filling	Medium sheared talc
Joint spacing	10cm (maximum)
Joint orientation	3 sides per block; 2 off vertical i.e. 1 steep joint set
Weathering	Moderate within 12 months

