UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACALAURIUS TECHNOLOGIAIE MINING ENGINEERING
SUBJECT	:	**MINING TECHNICAL SERVICES 4A**
CODE	:	**MTLA411**
DATE	:	FINAL SUMMATIVE ASSESSMENT 03 JUNE 2019
DURATION	:	3 HOURS
WEIGHT	:	60% OF FM
TOTAL MARKS	:	100

EXAMINER	:	MR H STRAUSS
MODERATOR	:	MR WB MOTLHABANE
NUMBER OF PAGES	:	6 PAGES

INSTRUCTIONS	:	QUESTION PAPERS MUST BE HANDED IN
REQUIREMENTS	:	1 SCRIPT, SECOND ON REQUEST

INSTRUCTIONS TO CANDIDATES:

WRITE YOUR STUDENT NUMBER ON THE FRONT PAGE OF YOUR QUESTION PAPER BEFORE YOU ANSWER ANY QUESTIONS.

ANSWER ALL THE QUESTIONS.

HAND IN YOUR QUESTION PAPER WITH YOUR SCRIPT.

QUESTION 1

1.1 State three infrastructure items that must be provided during rescue operations in abnormally hot environments. (3)

1.2 Briefly describe the causes of heat stroke and its effects on the human body. (4)

1.3 Make a neat sketch of the vapour compression refrigeration cycle. (4)

1.4 Describe the process in-, and purpose of each part of the cycle. (4)

1.5 What is meant by the term "Positional Efficiency" and why is it of significance? (2)

1.6 State the primary precautions required to reduce dust explosion risks. (6)

1.7 State three stone dusting quality control criteria. (3)

1.8 Distinguish between a detonation and a deflagration. (4)

[30]

QUESTION 2

2.1 The following measurements were recorded at a refrigeration plant:

Evaporator water in	23°C
Evaporator water out	4°C
Water mass flow	29kg/s
Compressor input motor power	820kW

2.1.1 Calculate the Plant duty. (2)

2.1.2 Calculate the overall compressor COP. (1)

2.2 If the plant described in 2.1 feeds a bulk air cooler where the rate of cooling is 1 700kW, what is the positional efficiency? (1)

2.3 If the water temperature difference in the BAC contemplated in 2.2 is 8°C, what is the mass flow of water that circulates through this BAC? (2)

2.4 If the temperatures of evaporation and condensation respectively are 2°C and 38°C, what is the Carnot COP and the overall cycle efficiency? (4)

[10]

QUESTION 3

3.1 Methane has been intersected in a tunnel that is ventilated with an exhaust system. The CH_4 concentration in the return air is 8% and the fan quantity is 4,5m^3/s. The column diameter is 760mm and the mean width of the tunnel is 4,2m. Propose a solution. (3)

3.2 Assess the explosibility of the following mixture of flammable gases. (7)

Methane	6%
Carbon monoxide	2%
Hydrogen	2%
Oxygen	9%

Show all calculations and graphics used in your assessment. Use the attached graph if required.

[10]

QUESTION 4

4.1 Write concise notes on the Impact Splitting Index Test, as applied in coal mining. You should state why and how it is done, and how the data is used in Rock Engineering. (10)

4.2 Determine the distance of a seismic event from an instrument that recorded an arrival time difference of 6ms, given that the rock mass elastic properties are:

Young's Modulus = 65GPa; Poisson's Ratio = 0,22.
The rock density is 2,7t/m^3, and the UCS is 210Mpa.

Show all calculations and SI units. (6)

4.3 Using the data tabulated below that was extracted from the database of a coalmine; determine a Q value for the rock mass in question. (7)

RQD	Total length of core >100mm = 470m Total length of core run = 745m
UCS	75MPa
Major Principal stress	20MPa
Ground water	Pressure of 0,5 kg/cm^3
Number of joint sets	One set plus random joints
Joint alteration/filling	No alteration – surface staining only.
Joint roughness	Rough, irregular, planar.

4.4 Using the data given in Appendix A, determine a value for the adjusted Mining Rock Mass Rating. (7)

[30]

QUESTION 5

5.1 You have been tasked to design a support layout for a narrow vein stope at a depth of 450m. You have the following data:

Rock density	3 020kg/m^3
Stoping width	120cm
Height of instability	140cm
Jointing	5 joints/m
UCS	190Mpa
Beam condition anticipated.	Competent – no special failure mode

Showing all assumptions and calculations, present a support geometry, based on an elongate peak strength of 150kN. (5)

5.2 How would you amend the layout if additional data showed that the roof beam thickness is only 100cm (not 140cm), and that beam buckling is now anticipated? (5)

5.3 You have been tasked to design a support system for a CM section and you plan to use resin point anchors. The following data is available:

Roof detail	Immediate roof consists of a 60cm succession of weakly bonded mudstone layers, each 20mm thick. This is overlain by a competent sandstone layer that is 75cm thick.
Roadway detail	6,5m wide and 3,4m high
Support detail	Resin point anchors; 20mm bolts; and 28mm holes. Resin shear resistance = 2Mpa. Rebar yield strength = 600MPa
Factor of safety	1,5

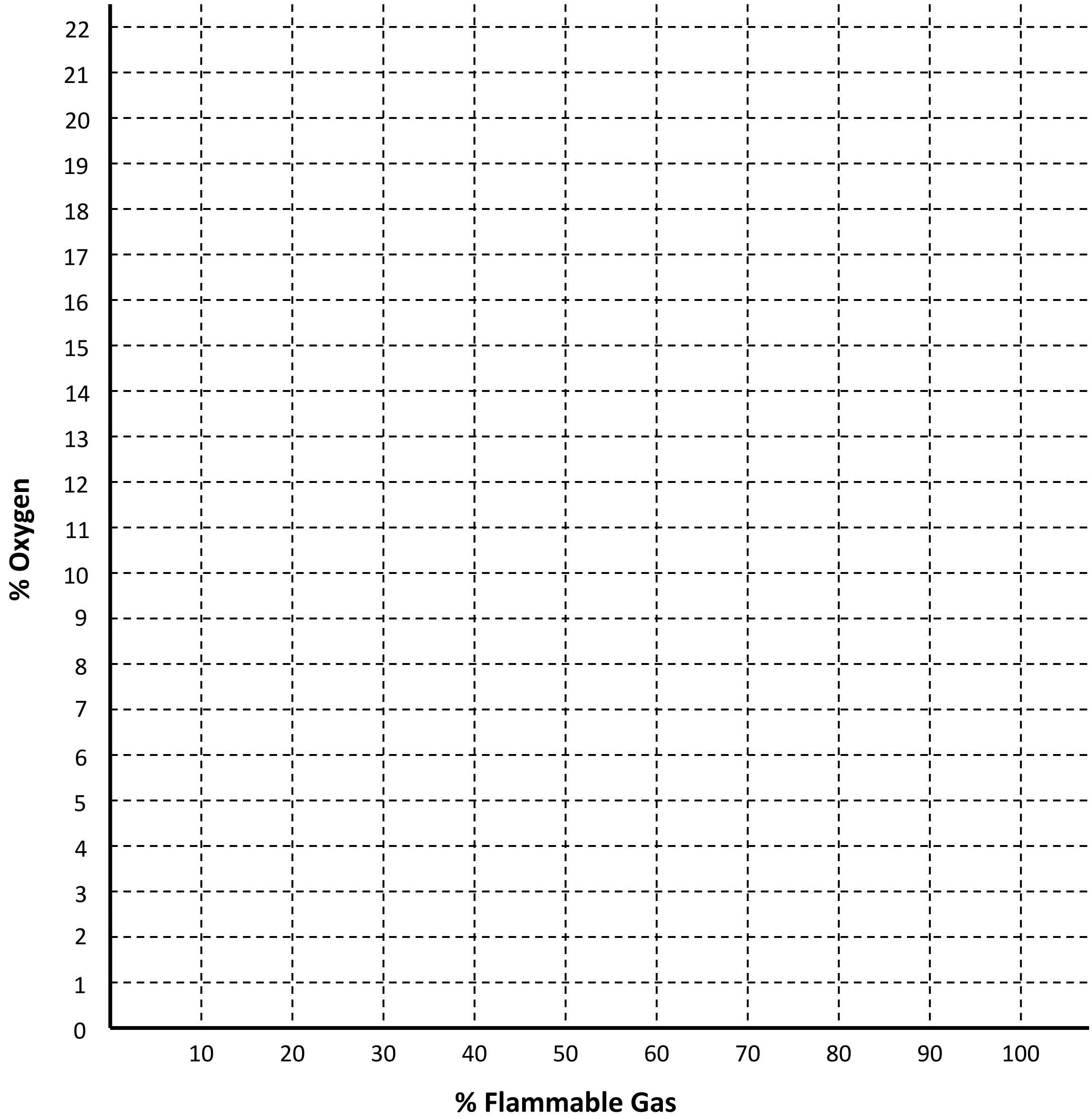
Showing all assumptions and calculations, present a support layout. (10)

[20]

TOTAL **[100]**

Appendix A – Geotechnical data

	Value
RQD (%)	83
UCS (MPa)	176
Ground water (l/min)	Moist
Number of joint sets	2
Large scale joint expression	Wavy, uni-directional
Small scale joint expression	Smooth, uni-directional
Joint wall alteration	Weaker than wall rock
Joint filling	Medium sheared talc
Joint spacing (cm)	10 (minimum)
Joint orientation	3 joints defining block; 2 off vertical
Weathering	Highly weathered within 24 months


% Oxygen
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
10
20
30
40
50
60
70
80
90
100
% Flammable Gas