PROGRAM	:	BACALAURIUS TECHNOLOGIAE MINING ENGINEERING
SUBJECT	:	**MINING TECHNICAL SERVICES 4A**
CODE	:	**MTLA411**
DATE	:	SUPPLEMENTARY SUMMATIVE ASSESSMENT 17 JULY 2019
DURATION	:	3 HOURS
WEIGHT	:	60% OF FM
TOTAL MARKS	:	100

EXAMINER	:	MR H STRAUSS
MODERATOR	:	MR WB MOTLHABANE
NUMBER OF PAGES	:	7 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 Briefly explain the precautions you would take when directing emergency work in an abnormally hot underground environment. (5)

1.2 State five requirements for approved stone dust. (5)

[10]

QUESTION 2

2.1 A stream of ventilating air enters a downcast shaft at a temperature of 8/12°C and a barometric pressure of 85kPa. Given that the geothermal heat load of the shaft is so little that it may be ignored and that the moisture content in the air increases by 10%, estimate the wet and dry bulb temperatures of the air stream at a depth of 1 950m, where the barometric pressure is 107,5kPa. (5)

2.2 If this air stream is then to be cooled down to a saturated temperature of 7°C in an underground bulk air cooler, estimate the chilled water requirements, given that the temperature rise of the water in the BAC is 9°C. (5)

2.3 The following measurements were recorded at a mine refrigeration plant:

Evaporator	
Water mass flow	44kg/s
Water temperature in	26°C
Water temperature out	4°C
Bulk air cooler	
Water temperature in	6°C
Water temperature out	23°C
Air temperature in	21/24°C
Air quantity in	85m^3/s
Barometric pressure	85kPa

Calculate:

2.3.1 The plant duty. (2)

2.3.2 The positional efficiency. (3)

2.3.3 The wet bulb temperature of the air leaving the bulk air cooler. (3)

2.3.4 The plant power consumption, given that the overall plant COP is 3,3. (2)

[20]

QUESTION 3

3.1 The following measurements are available at the site of a methane detection:

Methane concentration	6%
Roadway height	3,3m
Roadway width	6m
Air quantity (downstream of detection)	$25m^3/s$

3.1.1 Assess whether layering of methane would be likely beyond this intersection. Assume a horizontal airway. (5)

3.1.2 If layering is likely, what would the length of the layer be? (2)

3.1.3 By how much must the air velocity be increased to avoid layering? (3)

3.2 Assess the explosibility of the following mixture of flammable gases:

Methane	2%
Carbon monoxide	7%
Hydrogen	2%
Oxygen	8%

Show all calculations and graphics used in your assessment.

You may use the attached graph template if you wish (page 6). (10)

[20]

QUESTION 4

4.1 List four instrument errors that might occur during monitoring. (4)

4.2 List the three levels of monitoring advocated by van der Merwe et al. (3)

4.3 The stress induced on a fault with a dip of 30° and a friction angle of 26° is given in the matrix below. Determine whether seismic slip is likely on this fault. (6)

4.4 Given the following data of a rock mass, determine the adjusted MRMR. (7)

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

4.5 Using the coal mining related data tabulated below, determine a Q value. (10)

RQD	Total length of core >100mm = 2 255m Total length of core run = 3 355m
UCS	75MPa
Major Principal stress	20MPa
Ground water	Pressure of 2 kg/cm^3
Number of joint sets	2
Joint alteration/filling	Slightly altered joint walls, non-softening mineral coatings, sandy particles, clay-free disintegrated rock.
Joint roughness	Smooth undulating joints.

[30]

QUESTION 5

5.1 You intend using 200kN elongate support units (25cm thick) in a sequential grid stope that is 2 300m below surface. The density of the rock is 2 750kg/m^3 and there are no indications of severe jointing or faulting in the area. Head boards of 1m long will be used.

What support spacing will you recommend, given the following information?

Fall out height	110cm
Discontinuity friction angle	33°
Dip of extension fractures	44°
Dip of shear fractures	78°

(10)

5.2 You have to design a support system for an underground coal mining section with a room width of 6,5m. The immediate roof is made up of two layers as follows.

Layer	Description	Thickness (m)
Top	Sandstone	1,2
Bottom	Laminations (15mm) of Mudstone/Sandstone	0,4

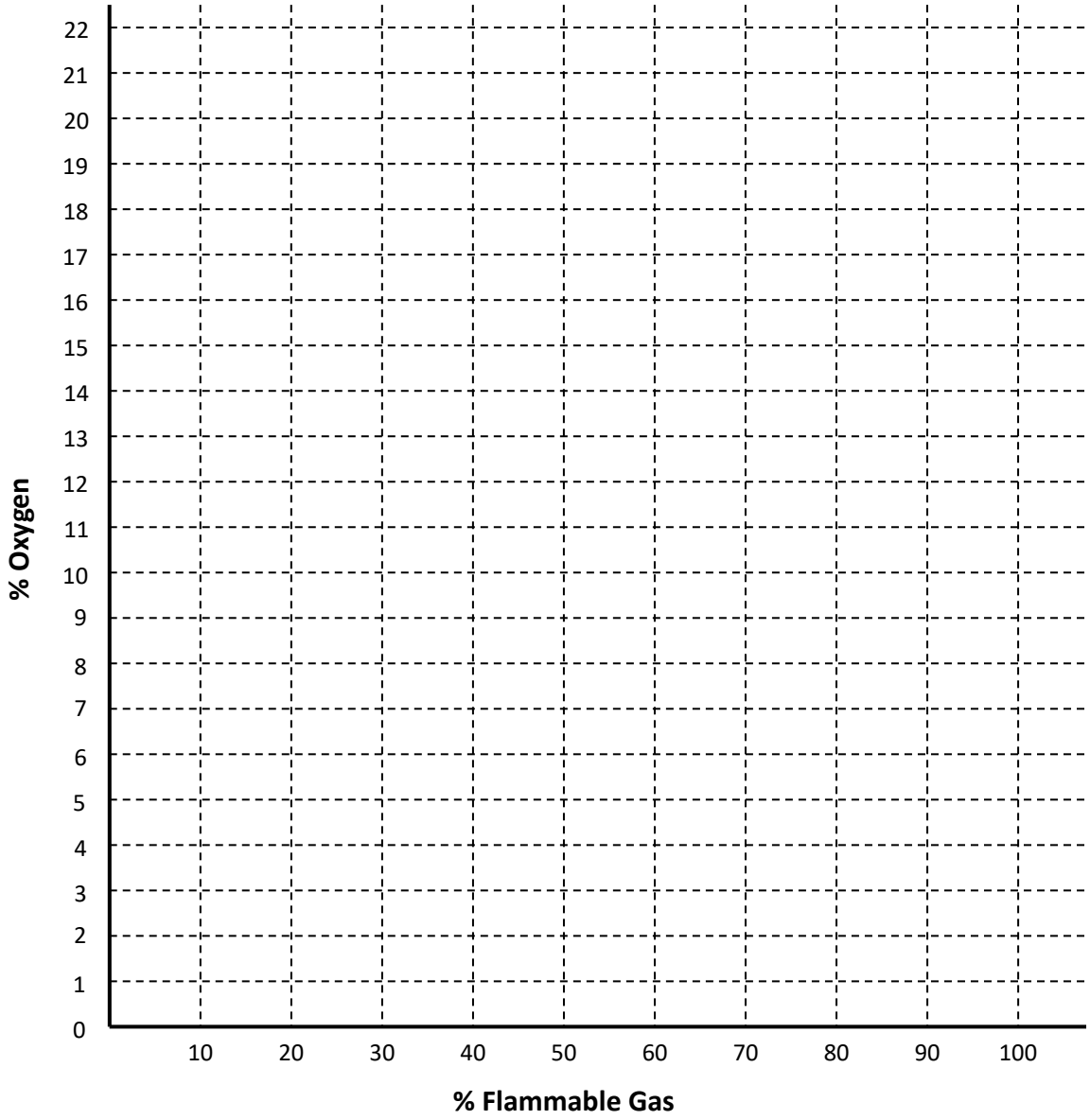
You intend using resin point anchors comprising 20mm bolts in 28mm holes.

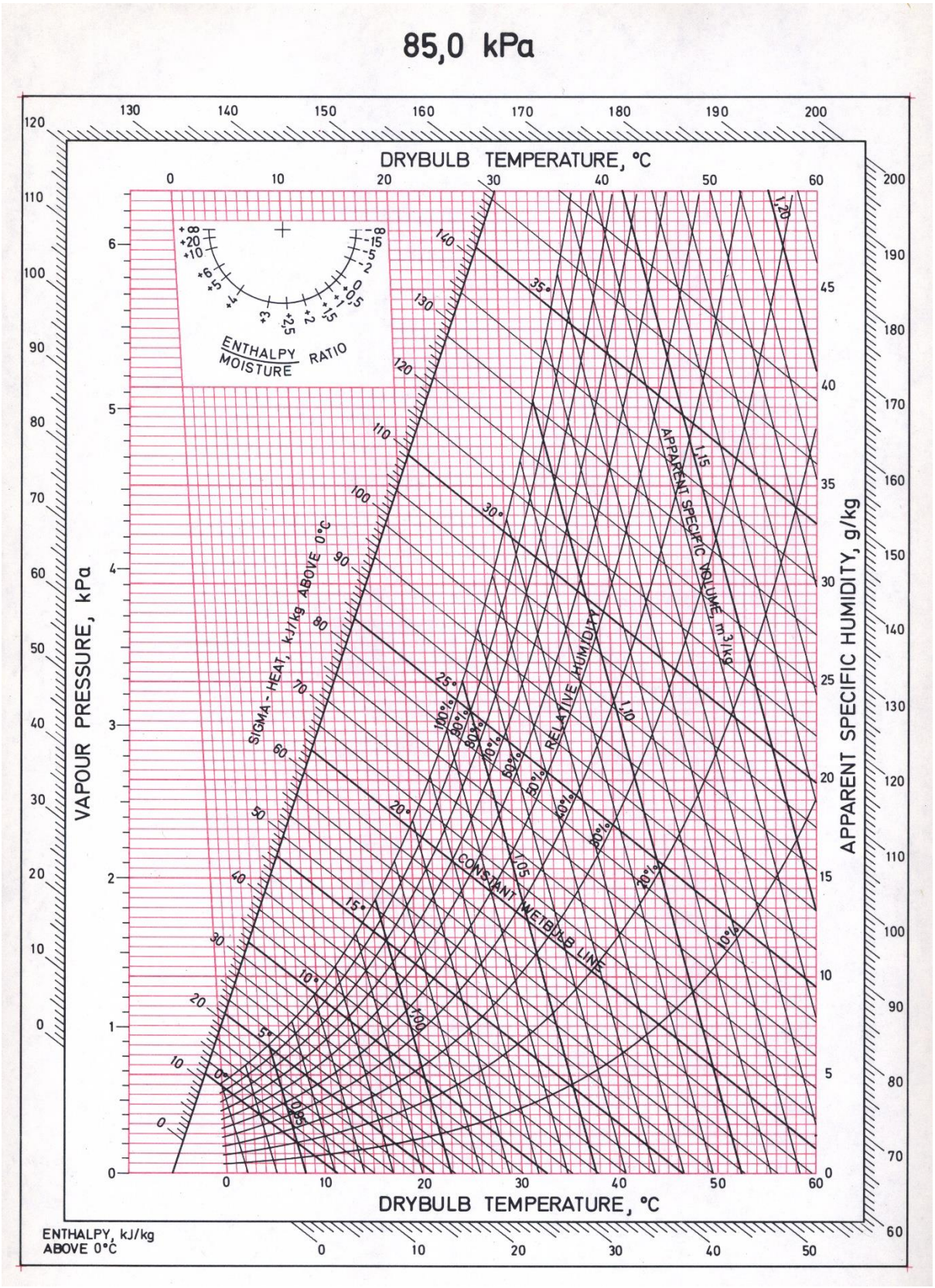
The shear resistance of the resin/contact plane is 2Mpa and the yield strength of the rebar to be used is 600Mpa.

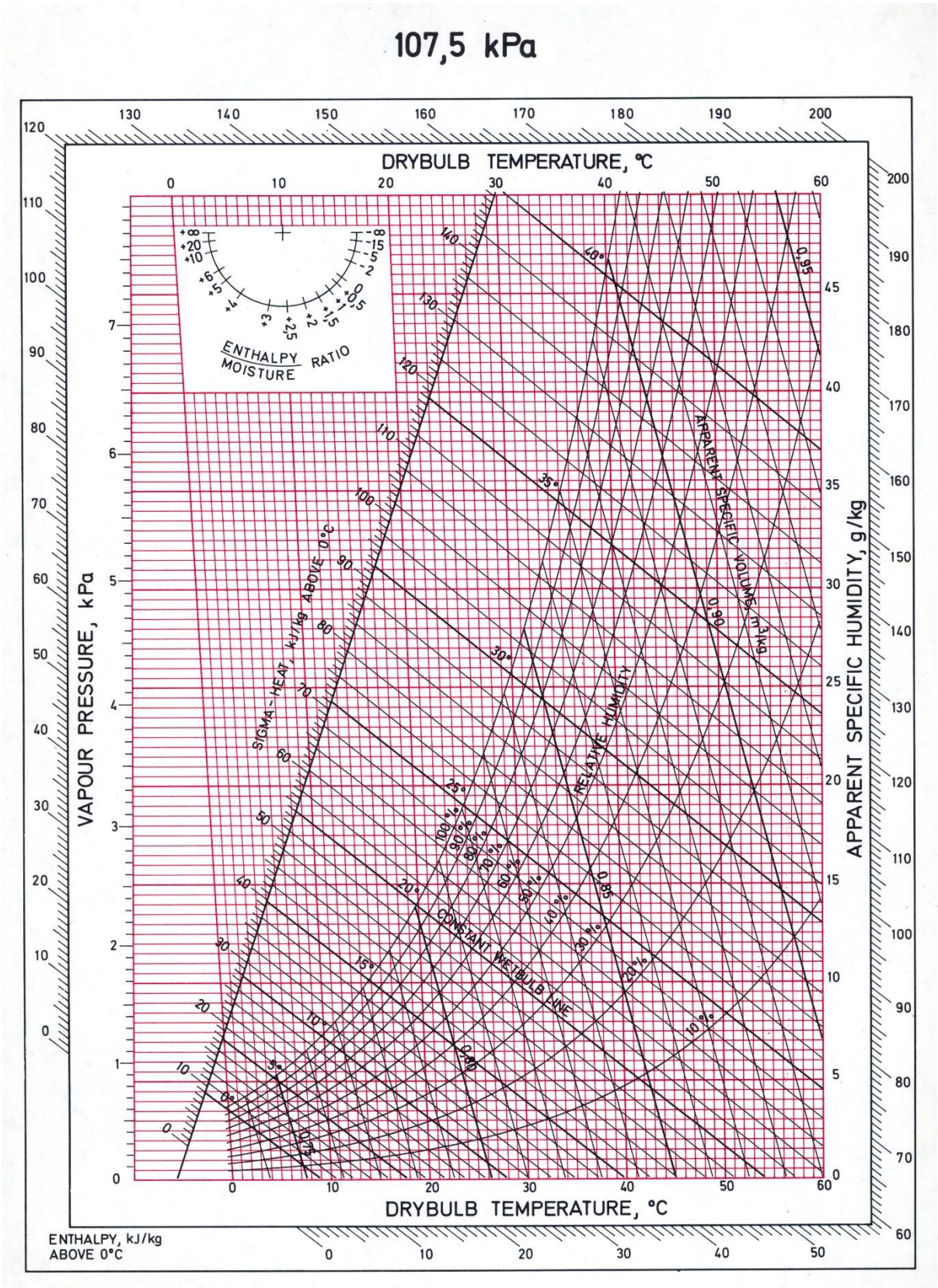
Conduct a full design sequence (using a safety factor of 1,5) and present a complete layout in plan view. (10)

[20]

TOTAL **[100]**


% 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


85,0 kPa
DRYBULB TEMPERATURE, °C
VAPOUR PRESSURE, kPa
APPARENT SPECIFIC HUMIDITY, g/kg
ENTHALPY / MOISTURE RATIO
SIGMA - HEAT, kJ/kg ABOVE 0°C
RELATIVE HUMIDITY
APPARENT SPECIFIC VOLUME, m³/kg
CONSTANT WETBULB LINE
ENTHALPY, kJ/kg ABOVE 0°C


107,5 kPa
DRYBULB TEMPERATURE, °C
VAPOUR PRESSURE, kPa
APPARENT SPECIFIC HUMIDITY, g/kg
ENTHALPY / MOISTURE RATIO
SIGMA-HEAT, kJ/kg ABOVE 0°C
RELATIVE HUMIDITY
APPARENT SPECIFIC VOLUME, m³/kg
CONSTANT WET-BULB LINE
ENTHALPY, kJ/kg ABOVE 0°C