

Minerals Council South Africa



EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL	EXAMINER: George Mapele
PAPER 3 – PLANNING, ECONOMIC, TECHNICAL LITERATURE	MODERATOR: Aldo Oosthuizen
SUBJECT CODE: COMMEC 3	TOTAL MARKS: [100]
EXAMINATION DATE: 11 May 2023	PASS MARK: (60%)
TIME: 14:30 – 17:30 (3 HOURS)	

NUMBER OF PAGES: 6 including this page

SPECIAL REQUIREMENTS:

THIS IS **NOT** AN **OPEN BOOK EXAMINATION**.

FORMULA HANDOUTS ARE AVAILABLE TO CANDIDATES:

1. Answer all 4 questions **legibly** in English.
2. Write your **ID 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.

3. Show all calculations and **check calculations on which your answers are based**.
4. Hand-held electronic calculators may be used for calculations.
5. Write **legibly**, in ink, on the **right hand page** only – **left hand pages will not be marked**.
6. Illustrate your answers by means of sketches or diagrams wherever possible.
7. Answers must be given to an accuracy which is typical of practical conditions.

NB: Ensure that the correct unit of measurement (SI unit) is recorded, as marks will be deducted from answers if the incorrect unit is used (even if the calculated value is correct).

8. Please note that you are not allowed to contact the examiner or moderator regarding this examination.
9. Cell phones and any other electronic devices are **NOT** allowed in the examination room.

QUESTION 1

Summarize one of the following articles (Choose between 1.1 and 1.2)

1.1 Pollutant. What are we doing? Why are we doing it? What should we be doing? (*Journal MVSS Volume 74 Number3 July /September 2021*).

1.2 Analysis of alternative board and pillar ventilation strategies. (*Journal MVSS Volume75 Number 1 January/March 2022*)

(20)

QUESTION 2

Determine the ventilation requirements for a coal mine and number of sections to be ventilated.

The following aspect must be considered:

Mining Method	Board and Pillar
Road Sizes	7m×3m
Air velocity over conveyor	2.0 m/s
Air velocity - Intake road	2.5 m/s
Air velocity - Return road	5.0 m/s
Standard Panel length	1.2 km
Design velocity in last through road	1.5 m/s
Production Tons/continuous miner/Month	90 000
Production Tons per year	9 000 000
Number of Roads for sections (Assumption)	5

(25)

QUESTION 3

A gold mine has decided to review its arc furnace dust collection system. The following two options /alternatives were considered:

OPTION 1

Overhaul the existing wet scrubber and replace the fan. The pressure drop across the scrubber would be 3.75 kPa and the dust collection efficiency would to 96.9%. The cost of these changes is estimated to be R 2 000 000.

OPTION 2

Replace the existing system with a 98.9% efficient fabric dust collector at a cost of R2 484 470. The average pressure drop across the system would be 1.83kPa.

Use the following information to determine which of the above options would be the most economical for the mine to implement.

- Project life is 15 years.
- Gold content of dust collected is 4.2 g/t.
- Gold price is R1 177 255/kg.
- Arc furnace operates 3 times/week for an average of 6 hours per smelt.
- Average dust emission from the furnace is 36.0 kg/hour.
- Ventilation air quantity is 4.8 m³/s and the overall fan efficiency is 76% for both options
- A two-week recess over Christmas was possible due to good performance which equalled annual gold production targets.
- Electrical power costs R2 500/kW/annum
- Wet scrubber maintenance cost is R5000kW/annum.
- Fabric collector maintenance and bag replacement costs are R430 000/year.
- Present value of R1 for 15 years at 15% interest is R5.85

(25)

QUESTION 4

4.1. The following design specifications given is for a Gold Mine in the Free State, South Africa:

Production rate per month	150 000 ton
Type of mining	Semi concentrated with a dip of 20° 80% ore body mined
VRT	47.5°C
Design Reject temperature	27.0°C
Expect fissure water used	15 l/s
Service water used	1 ton of water/ton of rock mined
Surface air Temperature	18°C
Temperature out of the BAC down the shaft	10°C
Positional efficiency of Refrigeration plant	80% (Surface plant)
Typical mass flow of air per Kton mined	5kg/s
Specific volume of air	0.95m ³ /s
Distance from station to working place	2000 m

Determine the following:

- 4.1.1 The mine's heat load, heat transferred as a result of fissure water and the total heat load of the mine. Use the graph attached and submit with your answer booklet.

- 4.1.2 The volume of air required in the mine. Use the graph attached and submit with answer booklet.
- 4.1.3 The cooling capacity of the downcast air
- 4.1.4 What should happen if the refrigeration plant is underground? (Motivate your answer by using one of the attached graphs and submit it with your answer booklet)

(15)

- 4.2. As an Environmental Engineering Manager **OR** Occupational Hygiene Manager, what specifications would you put in the tender document for a main fan? (List and briefly describe your answer for each specification)

(15)

(30)

Figure: 17.5a

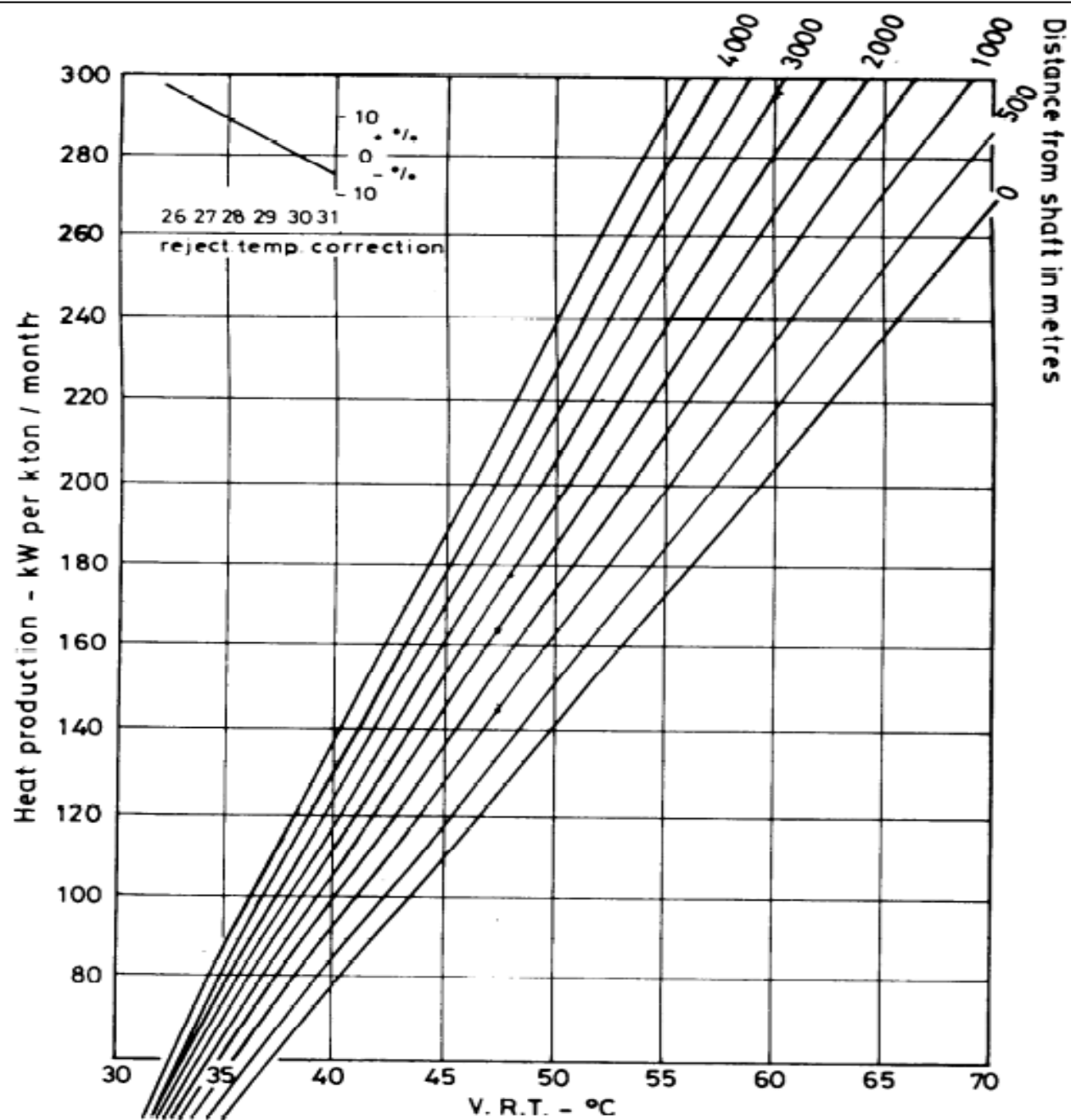


Figure 17.5a

Figure 17.9.1

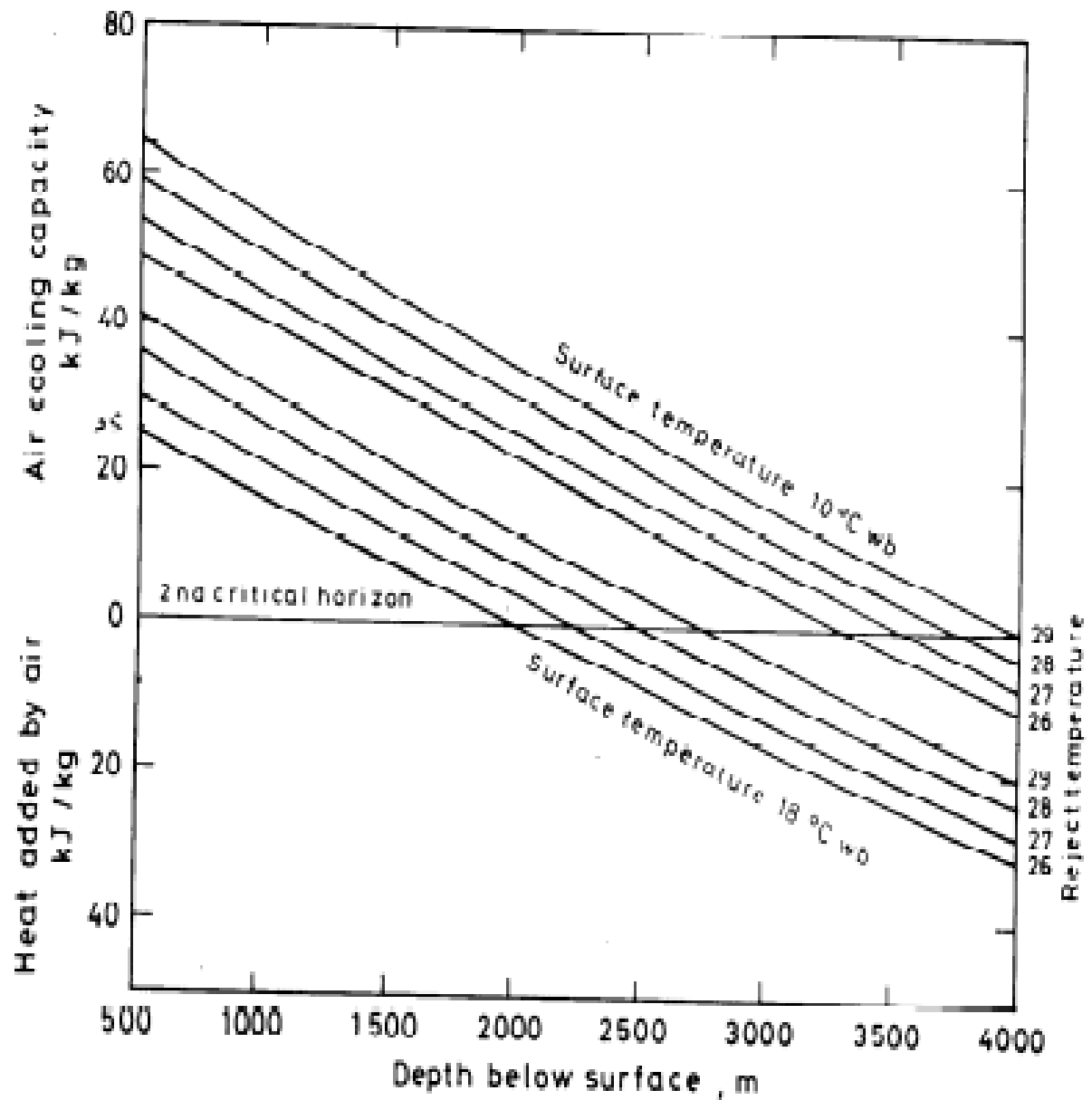


Figure 17.9.1

(100)