

# Minerals Council South Africa



## EXAMINATION PAPER

|                                                                                                                                                                                                                                               |                                                                                                                                             |
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| <p><b>SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – INTERMEDIATE CERTIFICATE IN MINE ENVIRONMENTAL CONTROL - PAPER 2</b></p> <p><b>SUBJECT CODE:</b> COMIMEC2</p> <p><b>EXAMINATION DATE:</b> 05 MAY 2025</p> <p><b>TIME:</b> 14:00 – 17:00</p> | <p><b>EXAMINER:</b> NEO DIKGALE</p> <p><b>MODERATOR:</b> NAVARRE KRUGER</p> <p><b>TOTAL MARKS:</b> [100]</p> <p><b>PASS MARK:</b> (60%)</p> |
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NUMBER OF PAGES: 4 (including this page)

### SPECIAL REQUIREMENTS:

*All candidates are advised to read the below instructions/requirements and adhere to them. Not adhering to them could lead to the loss of marks.*

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

1. Answer all 5 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 smart devices are **NOT** allowed in the examination room.
10. **The following chart is included: Psychrometric chart: 107.5 kPa**

**QUESTION 1**

- 1.1 List and describe the three methods of heat transfer between air and the environment and between man and the environment. (6)
- 1.2 Name and describe any five (5) main sources of heat in mines. List the ways in which to reduce each heat source mentioned. (10)
- 1.3 The VRT in Gauteng/West Wits is lower ( $9^{\circ}\text{C}/1000\text{m}$ ) than in the Free-State ( $14.6^{\circ}\text{C}/1000\text{m}$ ). State the reason for this? (2)
- 1.4 Describe the process of heat tolerance screening (HTS) (2)

**[20]****QUESTION 2**

- 2.1 The measured wet kata reading in a stope face is 12 and the wet-bulb temperature is  $30,9^{\circ}\text{C}$ . Calculate the air velocity. (3)
- 2.2 Calculate the approximate VRT at a depth of 2750m for a mine located in Klerksdorp (2)
- 2.3 Calculate the amount of heat required to change 3kg of ice at  $-4^{\circ}\text{C}$  to superheated water vapour at  $110^{\circ}\text{C}$ . If the process took 8 minutes, calculate the power involved? (10)
- 2.4 A flow rate of 8,3 L/s of water enters a cooling car at  $8,0^{\circ}\text{C}$  and leaves at  $17,0^{\circ}\text{C}$  after it absorbed heat from the air. Calculate the amount of heat transferred from the air to the water (Cooling car duty). (3)
- 2.5 What is the difference between sensible heat and latent heat? (2)

**[20]****QUESTION 3**

- 3.1 The following measurements were taken underground:

**Air-stream 1**

Wet bulb temperature =  $22,8^{\circ}\text{C}$

**Air-stream 2**

Qty:  $30\text{ m}^3/\text{s}$

Wet bulb temperature  $30,5^{\circ}\text{C}$

Calculate the air quantity to be supplied from air-stream 1 to make sure that the wet-bulb temperature after mixing does not exceed  $28,3^{\circ}\text{C}$  (3)

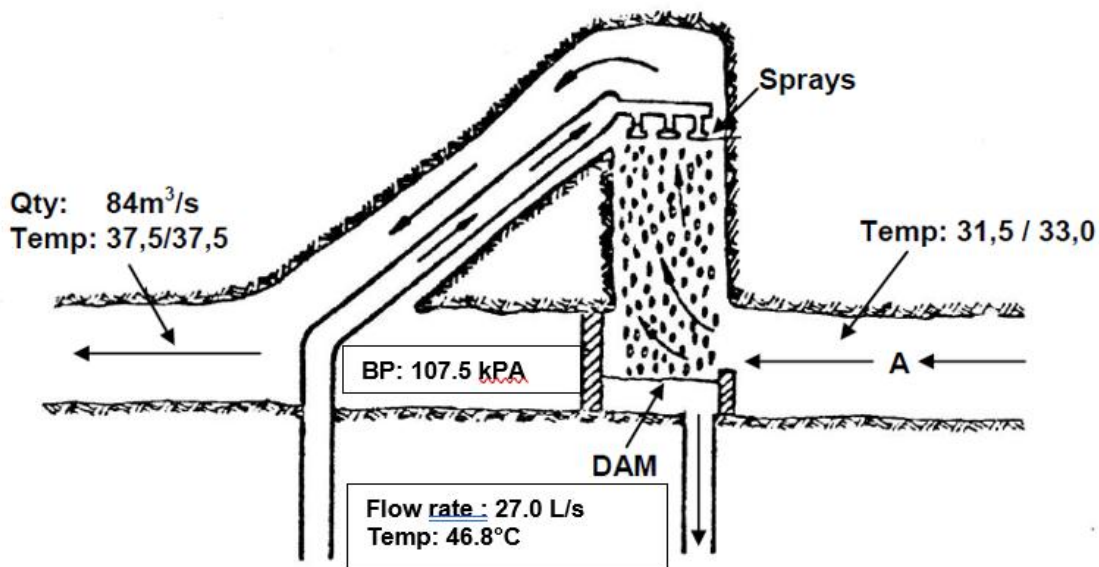
- 3.2 A certain mass of water vapour is cooled from 32,5°C to a temperature of 28,1°C. If the amount of heat removed is 261 kJ, calculate the mass of the water vapour. (3)
- 3.3 Discuss one Heat related disorder, its symptoms, causes, treatment and prevention. (2)
- 3.4 Describe five (5) measures to reduce the effects of cold stress (5)
- 3.5 Air enters a surface downcast shaft at an average velocity of 45km/h and a temperature of 0,0 / 5,0°C. Calculate the wind chill equivalent temperature (wind chill factor) (3)
- 3.6 Define the term "hypothermia" (1)

[20]

**QUESTION 4**

- 4.1 Define psychrometry. (1)
- 4.2 A volume of 200m<sup>3</sup> of air occupies an area at a pressure of 107,2 kPa. If the temperature remains constant, calculate the pressure, if  
 a) the volume decreases to 180m<sup>3</sup> (2)  
 b) the volume increases to 220,8m<sup>3</sup> (1)
- 4.3 Refer to the sketch below:

The sketch below represents an underground condenser cooling tower.



**4.3 Calculate:**

- (i) The heat added to the air. (3)
- (ii) The air quantity at point A. (2)
- (iii) The temperature of the water leaving the condenser cooling tower (state assumptions made) (2)
- (iv) Has water evaporated or condensed? (1)
- (v) How much water in litres / second has evaporated or condensed? (2)

**4.4** A bulk air cooler removes 2400 kW of total heat from the air. The mass-flow of air through the cooler is 100 kg/s. Calculate the unit heat exchange per kilogram of air. (2)

**4.5** Tabulate two (2) differences between heat absorption and heat rejection processes. (4)

**[20]**

**QUESTION 5**

**5.1** Discuss five objectives for sampling airborne pollutants. (5)

**5.2** Discuss the principle of operation of Gravimetric samplers and state one advantage of using these instruments. (3)

**5.3.** List the five ways in which dust can be controlled. (5)

**5.4** Name five (5) characteristics of an ideal filter. (5)

**5.5** Name two (2) reasons for sampling mine water (2)

**[20]**

**[100]**

# PSYCHROMETRIC CHART

## 107,5 kPa

