

Minerals Council South Africa



SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 4 – RISK MANAGEMENT. INFORMATION MANAGEMENT, FIRES & EXPLOSIONS, GASES AND STATISTICS SUBJECT CODE: COMMEC EXAMINATION DATE: 10 OCTOBER 2025 TIME: 14:00 – 17:00	EXAMINER: Thulile S Zamisa MODERATOR: RA Rabaji TOTAL MARKS: [100] PASS MARK: 60%
NUMBER OF PAGES: 4 (including this one)	
<u>SPECIAL REQUIREMENTS:</u>	
<i>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.</i>	
THIS IS <u>NOT</u> AN <u>OPEN BOOK EXAMINATION</u>. FORMULA HANDOUTS ARE AVAILABLE	
1. Answer all 4 questions <u>legibly</u> in English. 2. Write your <u>ID number</u> on the outside cover of each book used and on any graph paper or other loose sheets handed in. <u>NB:</u> Your name <u>must not</u> appear on any answer book or loose sheets. 3. Show all calculations and <u>check calculations on which the answers are based</u>. 4. Hand-held electronic calculators may be used for calculations. 5. Write <u>legibly</u> in ink on the <u>right-hand page</u> only – <u>left hand pages will not be marked</u>. 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. <u>NB:</u> Ensure that the correct unit of measure (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. In answering the questions, full advantage should be taken of your practical experience as well as data given 9. Please note that you are not allowed to contact your examiner or moderator regarding this examination. 10. This is <u>NOT</u> an open book examination but the approved formula hand out may be used. 11. Cell phones and any other electronic devices are <u>NOT</u> allowed in the examination room. <u>Only Calculator</u> 12. You are encouraged to make use of the CoMCert Tip-off Hotline whenever you witness or suspect any wrongdoing related to the CoMCert Examinations on landline 0800 118 998 or alternatively you can use email COMCert@tip-offs.com. This tip-off hotline and tip-off email is managed anonymously and confidentially through an independent service provider.	

QUESTION 1

- 1.1. It is planned to test the efficiency of a fire detection system by lighting a freely burning test fire in a return airway underground. Wood will be used for the fire at constant burning rate of 0.045 kg/s is expected.

The air quantity flowing in the return airway is 18m³/s with a specific volume of 0.80m³/kg.

- 1.1.1 What is the maximum theoretical increase you would expect in the CO₂ concentration in the airway? (6)

NOTE: The wood used has an average carbon content of 50% and 6 kg of carbon combines with 16 kg of O₂ to form 22 kg of CO₂.

- 1.1.2 Describe the scenarios that the presence of CO will influence your interpretation of the status of the fire. (4)

- 1.2 How would you extinguish the following fires, also indicate which fire class they belong to?

- 1.2.1 Fires involving Potassium (2)
- 1.2.2 Fires in the presence of Transformers (2)
- 1.2.3 Fires involving Methane (2)
- 1.2.4 Fires involving Aluminium (2)
- 1.2.5 Fires Involving Rubber (2)
- 1.2.6 Fires involving Benzene (2)

- 1.3 You are requested by the engineering department on your mine to calculate the maximum carbon monoxide emission from the exhaust of a vehicle driven by a 72kW compression ignition engine (diesel). The purpose is to ensure that the time weighted average exposure over an 8-hour shift (TWA), for CO is not exceeded, when operated in uncontaminated intake air.

The quantity of air used by the machine and released via the exhaust is 0.2 m³/s. Assume a clean airflow rate of 0.1 m³/s per kW of engine power.

- 1.3.1 Determine the required clean airflow rate for the operation of the engine. (1)
- 1.3.2 Determine the maximum CO level to be released not exceed the OEL of 25ppm. (5)

- 1.4 The most violent explosions of methane occur at concentrations between _____% and _____%. (2)

- 1.5 You have been informed that a fire is burning in a section of the mine. Immediately after this fire was sealed off, the Barometric pressure on both sides of the wall was measured at 110kPa.

On the next visit, the Barometric pressure behind the wall was 117kPa and 110kPa again on the access side. The seal was also found leaking. If the specific resistance of the seal was estimated to be 400Ns²/m⁸, then:

- 1.5.1 Which way did the air leak through the seal? (1)
- 1.5.2 What is the air quantity leaking through the seal? (1)
- 1.5.3 If 20m³/s of normal air containing nil ppm CO and 3000 ppm CO₂ flows past the seal where the leaking air contains 8% CO₂ and 2% CO by volume, determine what the ppm concentrations of these gases would be on the return side of the fire. (8)
- [40]**

QUESTION 2

- 2.1 Draw and discuss the purpose and application of a normal distribution curve using an example. (10)
- 2.2 Your individual Silica Quartz results for the year 2025 (assuming the year has ended) are as follows. All readings are in mg/m³.
- | | | | | |
|-------|-------|-------|------|-------|
| 0.020 | 0.031 | 0.041 | 0.01 | 0.016 |
|-------|-------|-------|------|-------|
- 2.2.1 Calculate the mean and 90th percentile and discuss what these values indicate. (3)
- 2.2.2 Indicate compliance to the 2034 Milestones and provide at least one specific reason for your answer (2)
- 2.3 What are the components that one would include in the opening sections of a formal report to submit to the mine management. Also give a brief description of each component. (10)

[25]

QUESTION 3

- 3.1 Briefly explain the four spacing requirements of where Flame Quenching barriers should be installed in a belt road. (5)
- 3.2 Briefly explain the following terminology in terms of reducing the risk of coal dust explosions.
- 3.2.1 Active workings (1)
 - 3.2.2 Face Area (1)
 - 3.2.3 Last Through Road (1)
 - 3.2.4 Too wet (1)
 - 3.2.5 Chain Road (1)
- [10]**

QUESTION 4

- 4.1 List the three forms of risk assessment and briefly describe the function of each in relation to occupational risk. (6)
- 4.2 List eight steps of an effective risk assessment (4)
- 4.3 You are requested to do a risk assessment for employees exposed to silica dust at your mine. Name 11 items of information that you will provide in this risk assessment as a 12.1 appointee. (11)
- 4.4 Hazard sources can be categorised into two main groups (4)
- Name these groups and list at least two examples of each group.
- [25]**
- TOTAL MARKS 100**