Minerals Council South Africa

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 4 – RISK MANAGEMENT. INFORMATION MANAMENT, FIRES & EXPLOSIONS, GASES AND STATISTICS **SUBJECT CODE: COMMEC** **EXAMINATION DATE: 15 MAY 2025** **TIME: 14:00 – 17:00**	**EXAMINER:** **Thulile Zamisa** **MODERATOR:** **Sarah Wheeler** **TOTAL MARKS: [100]** **PASS MARK: 60%**

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**. FORMULA HANDOUTS AVAILABLE

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 the 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 measure (SI unit) is recorded as marks will be deducted from answers if the incorrect or no units are used. (Even if the calculated value is correct).

8. Please note that you are not allowed to contact your examiner or moderator regarding this examination.
9. Cell phones and any other electronic devices are **NOT** allowed in the examination room. **Only Calculator**
10. 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.

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QUESTION 1

1.1. Define fire (1)

1.2. Apart from fuel, oxygen and heat, what is the fourth component of the fire pyramid? (1)

1.3. Explain why water or foam should never be applied to fires involving ammonium nitrate or nitro-glycerine-based explosives, especially if the materials have deteriorated with age. (1)

1.4. What five things must be considered before deciding to seal off the fire? (5)

1.5. Describe how gas sample results and temperature readings (whichever is applicable) can be used to assess the status of an underground fire. (10)

Explain how you would identify if the following parameters within the fire content as listed below:

a. Still burning freely
b. Being starved of oxygen
c. Under control
d. Flaring up, and what may be the main suspected cause
e. Considered to be extinguished

1.6. List four additional key personnel that should be in the Emergency Control Room as part of the core control team other than the Manager in Charge, Section Manager and Mine Overseer. (2)

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QUESTION 2.

2.1. Explain the following terms. (10)

a. Physical explosions
b. Electrical explosions
c. Implosion
d. Explosion
e. Explosive dust

2.2. Name five factors that affect the ignition sensitivity of coal dust. (5)

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QUESTION 3.

3.1. Discuss the four "T's" of Risk Control (4)

3.2. a. Describe the concepts of distribution of values (normal and log-normal distribution). Use sketches to support these concepts. (4)

b. Which of the above do gravimetric dust sampling results normally illustrate? (1)

3.3. What are the aims of Section 11(2) of the MHSA of 1996? (3)

3.4. A HEG has 180 employees, and the following represents individual respirable silica quartz samples that were taken in 2025.

Exposure Results mg/m^3	0.015	0.021	0.010	0.051	0.089	0.082	0.061	0.065	0.046

a) Calculate the mean and 90th percentile. (2)

b) Based on the OEL for silica, determine and calculate how many samples are required for this HEG in 2026? (2)

c) From the calculated values from your previous determination, which reading will be linked to medical records? (1)

3.5. Define the following terms (3)

a. Standard deviation

b. Confidence

c. Median

3.6. State Section 23 (1)(a) and (b) of the MHSA. (1)

3.7. List three methods that can be used to measure risk. (3)

3.8. What is the required approach for hazard identification? (3)

3.9. List the essential report requirements when documenting cases for chronic and acute occupational ill health or exposures. (4)

3.10. What are the four steps of Risk Management. (4)

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QUESTION 4. GASES

4.1. In an underground trackless mining section, the following diesel-powered rubber-tyred equipment is in use

- A 122kW LHD vehicle with an exhaust flow rate of 0.20m^3/s (de-rated).
- A 155kW dump truck with an exhaust flow rate of 0.15m^3/s (de-rated).
- An electrical driven drill rig.
- Auxiliary vehicles including a 35kW scissors lift and a 31kW utility vehicle.

a. Name six major airborne pollutants emitted from diesel engines and their respective OEL's (6)

b. Determine the quantity of air required in the section with an air ratio factor of 0.06m/s kW ratio (4)

c. Calculate the amount of air required at the point of application of the LHD if the exhaust fumes contain 140ppm NOx fumes (4)

d. How much fresh air would be required if both the LHD and dump truck are operating and each emitting 140ppm NO_x concentrations. (6)

4.2. Explain the following terms (6)

a. Absorbed dose

b. Stochastic effect (with an example)

c. Deterministic Effect (with an example)

4.3. Name four major forms in which natural radiation is classified. (4)

[30]

TOTAL MARKS 100

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