



EXAMINATION PAPER

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: COMMEC4 EXAMINATION DATE : 11 OCTOBER 2024 TIME: 14:30 – 17:30	EXAMINER: Thulile S Zamisa MODERATOR: Ramokone A Rabaji TOTAL MARKS: [100] PASS MARK: 60%
NUMBER OF PAGES 5 (including this page)	
<u>Examination Instructions:</u> This examination question paper consists of 4 pages 1. Answer all 4 questions in <i>English</i>. 2. Put your identification 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 only. 5. Write in ink on the right hand page only – the left hand page <u>will not</u> 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 units of measure (SI unit) are 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 NOT an open book examination but the approved formula hand out may be used. 11. Cell phones are NOT allowed in the examination room. 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. A mine's records indicates that a high percentage of the major motors suffer either newly installed (infant) mechanical failures (e.g. wiring and bearings) or environmental damage breakdowns within the first two years of the motor's life, or after being overhauled. Such motor outages are causing losses due to both high maintenance cost and production delay losses. What risk management process and programme should the environmental engineer introduce to reduce the losses and finance the cost of such losses? (10)
- 1.2. Name and explain the purpose of three forms of risk assessment methods. (6)
- 1.3. Define the following terms: (4)
- 1.3.1) Consequence
 - 1.3.2) Probability
 - 1.3.3) Frequency
- 1.4. Linking Occupational hygiene measurements to employee medical surveillance records are required in current legislation in terms of Section 13 of the MHSA, a computerised database system is recommended. List and briefly explain five duties required of the persons appointed, in terms of Section 12 and 13 of the MHSA, to comply with legislation. (5)

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QUESTION 2.

- 2.1. The mean dose WBGT for the 1st quarter is 27.0°C and the 90th percentile is 28.0°C, what do these values mean? Please also indicate what both these values are used for on the Quarterly DMRE reporting form for heat stress. (4)
- 2.2. In a set of temperature data with a range of 24.5°C to 33.5°C, it is found that the median is 28.1°C and the mean is 29.5°C. What does this variance tell you about the data? (2)

- 2.3. A HEG has 240 employees, and the following represents total individual respirable silica quartz samples were taken for Q3 (all readings are in mg/m³). This HEG is classified as A Category.

0.12	0.11	0.14	0.10	0.16
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- 2.3.1) Calculate the mean and 90th percentile (2)
- 2.3.2) Indicate if this represents sufficient samples for the quarter for the HEG with reasons for your answer (3)
- 2.4. Statistical analysis of many types of mine ventilation data indicates that the data follows a log-normal distribution
- 2.4.1) Describe the characteristics of this type of distribution (2)
- 2.4.2) Draw a sketch of a typical log-normal distribution, showing the relative position of the mean. (3)
- 2.5. Explain what you would expect to find in an abstract of an investigation report or a technical note. (3)
- 2.6. When is it necessary to have preface on a report and what does it provide? (2)
- 2.7. Explain what you understand about Section 22(d) and Section 23 (1)(a) and (b) of the MHSA. (4)

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QUESTION 3.

- 3.1. Name the at least four types of gases encountered during each of the following mining operations (four dangerous gases per operation).
- 3.1.1) Burning of PVC-coated electric cables (2)
- 3.1.2) Diesel engines (2)
- 3.1.3) Blasting (2)
- 3.2. Convert the following to ppm
- 3.2.1) 2,59% (1)
- 3.2.2) 0.05% (1)

3.3. List four methods of taking gas samples from a sealed area? (4)

3.4. The underground workshop on your mine performs regular exhaust maintenance of diesel equipment before allowing the machines to operate. You are requested to provide a figure of maximum CO emissions from the exhaust of a vehicle driven by a 170kW compression ignition engine. The purpose is to ensure that the OEL for CO is not exceeded. The quantity of air used by the engine and released via the exhaust is $0.6\text{m}^3/\text{s}$.

Assume that the engine certification requires an airflow rate of $0.085\text{m}^3/\text{s}$ per rated kW of engine power when the engine is clean and running to specification and that your mine ventilation system has been designed to achieve this, with no availability of excess air.

Determine the following

3.4.1) The required clean airflow rate of the operation of the engine (1)

3.4.2) The maximum CO release rate at the exhaust of the engine, at which point the engine must be serviced. (3)

3.5. A 10 000litre petrol tank (highly flammable) was damaged which resulted in a big hole in the tank. The engineering team wants to Arc weld this petrol tank together which still has half of the petrol left inside. Provide the steps that you should take to conduct a clearance permit for the team to enter the tank. (6)

3.6. An airstream contains $0.3\text{kg}/\text{s}$ of carbon dioxide. Determine the quantity of carbon dioxide (Assume air density of $1.1\text{kg}/\text{m}^3$) (3)

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QUESTION 4.

4.1. What is the purpose of having a refuge bay and where should a refuge bay be located? (5)

4.2. How would you extinguish fires at the following places; (4)

4.2.1) Electrical sub-station.

4.2.2) Hot metal fires.

4.2.3) Trash accumulations.

4.2.4) Rooms containing electrical/electronic equipment.

4.3. What special precautions should be applied when extinguishing fire involving: (4)

4.3.1) Flammable liquids.

4.3.2) Electrical equipment.

4.4. When a gas sample taken underground has been analysed, the percentages of various gases can be used to calculate the Graham's, Willet's and Young's ratios.

4.4.1) Explain the meaning used in each ratio? (6)

4.4.2) Determine and explain the value of each of the above ratios for a gas sample which was analysed as follows; (6)

O ₂	20,15%
N ₂	78,60%
CO ₂	0.032%
CH ₄	1.20%
H ₂	0,01%
CO	0.008%

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TOTAL MARKS 100