

Minerals Council South Africa



EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 5 SUBJECT CODE: COMMEC5 EXAMINATION DATE: 14 OCT 2024 TIME: <u>14:30 – 17:30 (3 HOURS)</u>	EXAMINER: NEO DIKGALE MODERATOR: SUSAN SWANEPOEL TOTAL MARKS: [100] PASS MARK: (60%)
NUMBER OF PAGES: 4 (including this page)	
<u>SPECIAL REQUIREMENTS:</u> THIS IS <u>NOT</u> AN <u>OPEN BOOK EXAMINATION</u>. FORMULA HANDOUTS MUST BE MADE AVAILABLE TO CANDIDATES 1. Answer all <u>4</u> questions in <i>English</i>. 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 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. <u>NB:</u> 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. Cell phones and any other electronic devices are <u>NOT</u> allowed in the examination room. <u>Only Calculator.</u> 11. 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 Discuss the physiology of the human respiratory defence mechanism against inhaled particulate matter (i.e. how does the body defend itself against inhaled dusts): (6)
- 1.2 Briefly discuss the pathological effects of exposure to the skin by:
- 1.2.1. primary irritants, (1)
 - 1.2.2. sensitisers, (1)
 - 1.2.3. extremes of heat and cold, and (1)
 - 1.2.4. alkaline or acidic chemicals. (1)
- 1.3 Name the six essential pillars of a Hearing Conservation Programme (HCP) which must be integrated for success in preventing noise induced hearing loss. (6)
- 1.4 Name the section of the Mine Health and Safety Act under which the Occupational Hygienist is appointed. (1)
- 1.5 What qualifications should an Occupational Hygienist have, who works in the following areas:
- 1.5.1 Mine (1)
 - 1.5.2 Surface operations and plants (1)
- 1.6 Name the section of the Mine Health and Safety Act under which a risk assessment is conducted. (1)

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QUESTION 2

- 2.1 Medical surveillance and a formal, routine audiometric examination becomes mandatory for all workers exposed to an equivalent, continued A-weighted sound pressure level (LAeq, 8h) exceeding 85dB(A). List two main purposes of industrial audiometry. (2)
- 2.2 As the Occupational Hygienist of a mine, you are required to conduct an Airborne Pollutant Health Risk Assessment on a new workplace at the mine. With reference to the DMRE Mandatory Guideline on a Code of Practice for an Occupational Health Programme on Personal Exposure to Airborne Pollutants, describe the information that needs to be recorded in the report of the assessment. (10)
- 2.3 During ergonomic design or selection of controls for operators, list four factors that should be taken into account. (4)
- 2.4 List three factors which will determine the selection of a respirator. (3)
- 2.5 Name one factor that influences visual acuity. (1)

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QUESTION 3

- 3.1 What are the two primary functions of hearing? (1)
- 3.2 Name and discuss the hierarchy of controls (i.e. not PPE) that can be used to control equipment noise in the workplace. (5)
- 3.3 Calculate the maximum allowable duration of exposure under the circumstances below. Complete the table: (2)

Noise level (dB) -South Africa	Maximum duration of exposure (hrs per day)
88	3.3.1
3.1.2	2
95	3.1.3
3.1.4	0.5

- 3.4 A fan undergoing test in a large, flat, obstacle free area, produces a sound pressure level of 0.8Pa, with measurements taken on the surface of an imaginary hemisphere with a radius of 5m.
- 3.4.1 Determine the sound pressure level of the fan (2)
- 3.4.2 Calculate the sound power level of the fan (4)
- 3.5 A second identical fan is installed next to the fan in 3.4 above. Calculate the:
- 3.5.1 sound pressure level at 5m (2)
- 3.5.2 sound power level of both fans (1)
- 3.6 An employees' 8-hour TWA noise exposure was measured as 93 dB(A) (using a personal worn noise dosimeter), is using disposable hearing protection devices with a NRR of 29 dB(A). Calculate the estimated 8-hour TWA exposure of the employee when using the provided hearing protection devices for the full 8-hour shift. (3)

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QUESTION 4

- 4.1 Discuss the fundamental approach to dust control, based on a three-fold approach under the following headings: Engineering controls, administrative controls and PPE. (8)
- 4.2 Diesel Particulate Matter (DPM) has become a significant occupational stressor in most mechanised mines.
- 4.2.1. Name two methods that can be used as substitution controls for DPM. (2)
- 4.2.2. Name two methods that can be used as engineering controls for DPM (2)

4.2.3. What type of respiratory protection can you as an appointed occupational hygienist recommend for workers exposed to diesel particulate matter in their workplaces? (1)

4.3 The following information is obtained from a gravimetric dust sample taken underground:

Pump flow rate = 2,2l/min

Pump running time = started 05h00, switched off 13h50

Pre weighed filter mass = 20,88mg

Post weighed filter mass = 21,14mg

Control filter pre weighed filter mass = 20,00mg

Control filter post weighed filter mass = 20,09mg

Silica content of sample = 20%

4.3.1 Determine the Air Quality Index for Silica dust. (6)

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QUESTION 5

5.1 Electrostatic precipitators are often used as particulate collectors of choice. Describe and sketch the principle of operation of an electrostatic precipitator. Name one advantage of using an electrostatic precipitator for dust control purposes. (5)

5.2 Air volume of 75m³/s flows in an intake airway towards a working section. Before entering the working section, 10m³/s is drawn off and passed through a filter leaving with a dust concentration of 1.20mg/m³. An air volume of 60m³/s is passed through a bulk air cooler leaving with a dust concentration of 0.99mg/m³. After re-mixing of the air streams and before the air enters the working sections, the dust count of the mixture is 1.70mg/m³.

5.2.1 Calculate the dust concentration of the original 75m³/s. (3)

5.3 Reference is often made to “ergonomic hazards” in the workplace. List four major ergonomic risk factors in the workplace. (4)

5.4 The occupational exposure assessment comprises three steps: Name and describe these steps. (6)

5.5 The atmosphere in a workplace contains 250ppm of acetone (OEL= 500ppm), 100ppm of ethyl acetate (OEL = 200ppm) and 120ppm of methyl ethyl ketone (OEL = 200ppm). This mixture has a total atmospheric concentration of 470 ppm. Is this mixture complying with legal requirements? (2)

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