

Minerals Council South Africa



EXAMINATION PAPER

SUBJECT: OCCUPATIONAL HYGIENE CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 5 - OCCUPATIONAL HYGIENE SUBJECT CODE: COMMEC 5 EXAMINATION DATE: 12 MAY 2026 TIME: 14H00 – 17H00 (3 Hours)	EXAMINER: S Bergh MODERATOR: M Melk TOTAL MARKS: 100 PASS MARK: 60%
NUMBER OF PAGES: 4 (including this page)	
<u>SPECIAL REQUIREMENTS:</u> <p style="color: red; text-align: center;"><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></p> <p>THIS IS <u>NOT</u> AN <u>OPEN BOOK EXAMINATION</u>. FORMULA HANDOUTS AVAILABLE</p> <ol style="list-style-type: none"> Answer all 4 questions <u>legibly</u> in English. 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. Show all calculations and check calculations on which the answers are based. Hand-held electronic calculators may be used for calculations. Write <u>legibly</u> in ink on the <u>right-hand page</u> only – <u>left hand pages will not be marked</u>. Illustrate your answers by means of sketches or diagrams wherever possible. 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 or no units are used. (Even if the calculated value is correct). Please note that you are not allowed to contact your examiner or moderator regarding this examination. Cell phones and any other electronic devices are <u>NOT</u> allowed in the examination room. <u>Only Calculator</u> 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 The table below represents daily employee exposure to Carbon Monoxide. Determine whether the employee was overexposed. (4)

Date	User	Instrument	Peak Reading(ppm)	Average Reading (ppm)	Duration (seconds)
6/10/2023	User X	16071GY-024	157.00	139.00	20
6/10/2023	User X	16071GY-024	93.00	31.20	15240
6/10/2023	User X	16071GY-024	99.00	96.30	510
6/10/2023	User X	16071GY-024	138.00	121.40	2360
6/10/2023	User X	16071GY-024	140.00	113.80	5570
6/10/2023	User X	16071GY-024	104.00	101.90	480
6/10/2023	User X	16071GY-024	98.00	96.20	390
6/10/2023	User X	16071GY-024	105.00	102.80	470
6/10/2023	User X	16071GY-024	106.00	103.90	510
6/10/2023	User X	16071GY-024	108.00	108.00	10

- 1.2 Briefly discuss the properties of:

- Fume
- Mist
- Vapour

(6)

Give an example of where you could expect to encounter these various aerosols

- 1.3 List and describe five multiple functions of the human skin. (10)

- 1.4 Match the airborne pollutant in Column A with the sample media arrangements in Column B. List occupational exposure limits as per Schedule 22 of the Mine Health & Safety Act 29 of 1996 as amended for each pollutant in Column A. (10)

Column A			Column B	
A	Respirable crystalline silica	NIOSH 7500	1	Filter (0.8 µm cellulose ester membrane). Back-up paper impregnated with sodium carbonate
B	Mercury	NIOSH 6009	2	Solid sorbent tube (coconut shell charcoal, 100 mg)
C	Lead	NIOSH 7300	3	5.0-µm, silver membrane
D	Arsenic & inorganic	MDHS 41/2	4	Solid sorbent tube (Hopcalite in single section, 200mg)

	compounds of arsenic	
E	Chromium, hexavalent	NIOSH 7600

5	Filter (5.0-µm PVC membrane)
6	PTFE, 0.5-µm + silver membrane, 25-mm, 0.45-µm
7	Filter (0.8 µm cellulose ester membrane)
8	Cyclone & filter

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Question 2

- 2.1 Define the terms “inhalable”, “thoracic” and “respirable” dust. (6)
- 2.2 List the individual components of the gravimetric sampling train used for the membrane filter method of sampling fibres (RTM1 method) (6)
- 2.3 When measuring a welders’ exposure to welding fumes, where should the cassette be ideally positioned to obtain a representative sample and why? (4)

A table below represent welding fumes results, interpret the results and motivate your answer.

Welding Fumes	Flowrate	Sampling Time	Volume	TWA	OEL
<i>Respirable Welding Fumes, containing</i>	2.199	505	1.110	1.2517	5.000
<i>Silver (Ag)</i>				0.0001	0.200
<i>Aluminium (Al)</i>				0.0076	2.000
<i>Cadmium Oxide (CdO)</i>				0.0001	0.004
<i>Cobalt (Co)</i>				0.0001	0.040
<i>Chromium (Cr)</i>				0.0014	1.000
<i>Copper Oxide (CuO)</i>				0.0005	0.400
<i>Iron Oxide (FeO)</i>				0.2966	10.000
<i>Manganese (Mn)</i>				0.0557	0.040
<i>Nickel (Ni)</i>				0.0001	3.000
<i>Lead Oxide (PbO)</i>				0.0001	0.150
<i>Titanium Dioxide (TiO₂)</i>				0.0041	10.000
<i>Zinc Oxide (ZnO)</i>				0.0057	4.000
<i>AQI</i>				1.711	

- 2.4 Reference is often made to “ergonomic hazards”, or “ergonomic problems” in the workplace. However, as ergonomics strives for a healthy and safe workplace, the hazards actually results from the *absence* of ergonomic considerations. These conditions are more correctly called “ergonomic risk factors: List four (4) major ergonomic risk factors. (4)

[20]

Question 3

- 3.1 Describe the basic characteristics of sound. (5)
- 3.2 Provide and discuss the elements of a good hearing conservation programme, as outlined within the Guideline for the Compilation of a Mandatory Code of Practice for and Occupational Health Programme (Occupational Hygiene and Medical Surveillance) for Noise. (20)
- 3.3 List five (5) physiological effects associated with excessive exposure to noise. (5)

[30]

Question 4

- 4.1 Describe the various causes of occupational skin disorders under the following headings:
a) Chemical
b) Mechanical
c) Physical
d) Biological
e) Botanical (10)
- 4.2 List four (4) fundamental components that are common to all LEV (local exhaust ventilation) systems. Support your answer with a diagram of the components of a LEV system. (6)
- 4.3 Calculate the volume of fresh air containing 0.80 mg/m^3 of dust to be mixed with $11.5 \text{ m}^3/\text{s}$ of air containing 3.50 mg/m^3 of dust to reduce the dust concentration to 2.50 mg/m^3 . (4)

[20]

TOTAL MARKS [100]