

Minerals Council South Africa

EXAMINATION PAPER



SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 5 – OCCUPATIONAL HYGIENE SUBJECT CODE: COMMEC5 EXAMINATION DATE: 13 MAY 2019 TIME: 14:30 – 17:30	EXAMINER: JJ van Staden MODERATOR: C Badenhorst TOTAL MARKS: [100] PASS MARK: (60%)
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NUMBER OF PAGES: 7

SPECIAL REQUIREMENTS:

THIS IS NOT AN **OPEN BOOK EXAMINATION**. FORMULA HANDOUT WILL BE AVAILABLE

INSTRUCTIONS TO CANDIDATES:

1. Answer all 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) 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 are **NOT** allowed in the examination room.

QUESTION 1

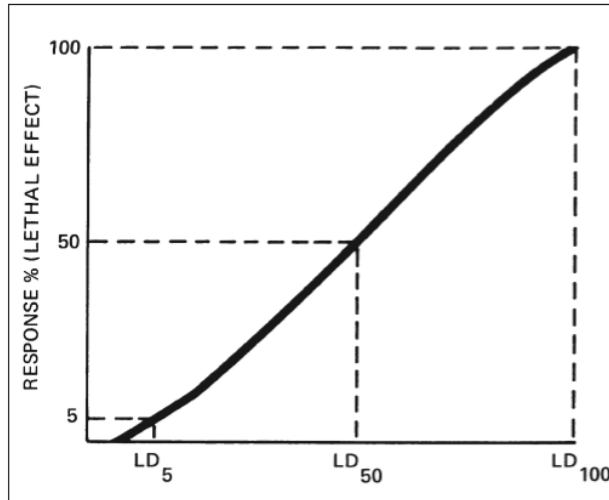
- 1.1 Describe the primary objective of an occupational health and safety program. (1)
- 1.2 List the key elements of an occupational hygiene program. (4)
- 1.3 The various workplace health hazards or stresses that could result in impaired health and wellbeing amongst employees are categorised as chemical, physical, biological, or ergonomic. Describe chemical and ergonomic stressors with relation to origin & health effects. (4)
- 1.4 By means of a sketch, explain the route a respirable particulate may follow through the respiratory track if inhaled. (3)
- 1.5 Oxygen-deficient atmospheres may exist in confined spaces as oxygen is consumed by chemical reactions such as oxidation (rust, fermentation, etc.).
- i) What would be the first physiological symptoms which may be experienced by an employee when exposed to an oxygen deficient atmosphere? (2)
 - ii) What PPE item should be used by an employee before entering such an oxygen deficient confined space? (1)
- 1.6 A recent finding from the Regional Inspectorate revealed that sanitation/sewage workers are exposed to biological hazards which were not covered in the Mine's baseline health risk assessment. Considering the potential risk of exposure and non-compliance, what would your recommendation be to the Section 13 Appointee of the Mine? (2)
- 1.7 Complete the definition of an OEL STEL: *An OEL STEL is a _____ min TWA exposure that should not be exceeded at any time during a workday, even if the eight-hour TWA is within the 8h OEL-TWA. Occupational exposures above the OEL-TWA up to the STEL should not exceed _____ minutes and should not occur more than _____ times per shift. There should be at least _____ minutes between successive exposures in this range.* (4)
- 1.8 Several of the substances in the MHSA Schedule 22.9(2)(a) OEL list are accompanied by a "skin notation". What is the purpose of the notation? (2)
- 1.9 What does the term "Pleurisy" refers to? (2)
- 1.10 An employee claims to have been accidentally exposed to carbon monoxide (CO) when he passed a substation which flashed underground releasing a large cloud of smoke and gas. Explain in your own words the potential physiological effects that could result from the exposure. (2)
- 1.11 What does the term LC50 refers to? (2)
- 1.12 Explain what is meant by a "Simple Asphyxiant" and give an example of such substance. (2)

- 1.13 Briefly discuss the potential ill health effects associated with extensive shift? (5)
- 1.14 Define “Mutagens” (2)
- 1.15 Define “Biological exposure index” (BEI) (2)

[40]

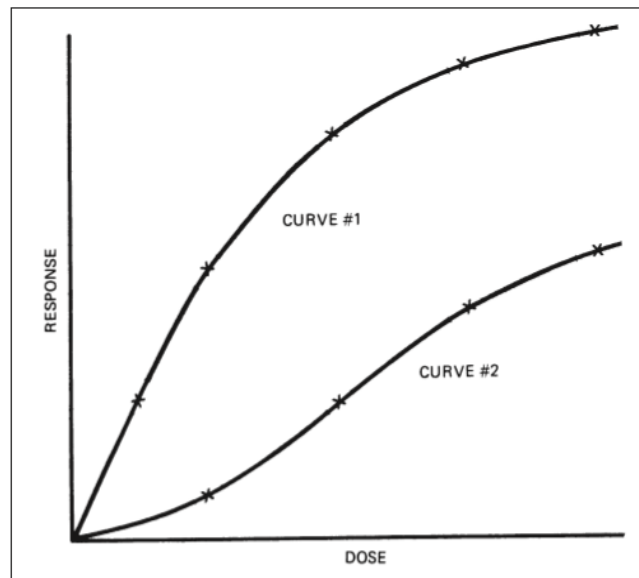
QUESTION 2

2.1 Explain in your own words what information is represented in the graph below.



(4)

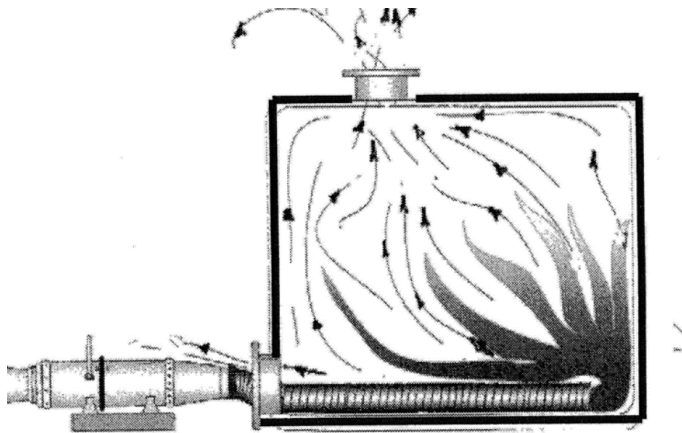
2.2 The diagram below illustrates the dose-response curves of two (2) chemical substances. Which one of the two (2) curves represents a lower margin of safety? Provide a motivation for your answer.



(3)

2.3 When measured at the same location, four noise sources have sound pressure levels of 89, 87, 78, and 81 dB(A), respectively. What would the sound pressure level at this location be if all four sources were running concurrently? (3)

2.4 The confined space below requires a total amount of 30 air changes per hour as per the Site's operational standard. Calculate the actual air changes with the provided information. Compare your answer to the required standard of 30 per hour. Has the Site requirement been met? (6)



Diameter of the ventilation ducting = 0.25m

Velocity measured at duct discharge = 15m/s

Volume of confined space = 40m³

2.5 List the factors that could influence good illumination. (4)

Question 3

- 3.1 A thermal stress survey on a Tailings Dam has yielded the following results: (4)

Wet-bulb temperature = 28°C

Dry-bulb temperature = 37°C

Globe temperature = 41°C

Calculate the WBGT index and comment of the result.

- 3.2 Calculate the wavelength (in air) for a noise source of frequency 2800 Hz. (3)

- 3.3 A noise source of an intensity of 25 W/m² is present in a position where the air density is known to be 1.2 kg/m³. Determine the sound pressure level of this source. (4)

- 3.4 You are performing a ventilation survey on an exhaust hood with duct work. With reference to the tables below fill in the possible causes against the indicators observed. (9)

Exhaust Hood	
Indicator	Possible Cause(s)
Low Capture Velocity	List any 4 possible causes
Reduced Face Velocity	List the cause

Ducts	
Indicator	Possible Cause(s)
Constant restriction	List any possible 4 causes

- 3.5 What types of ventilation strategies can be applied to remove welding fumes from a welder's breathing zone? Also indicate the most effective method? (4)

- 3.6 A fan is in the centre of a large flat area free of any obstructions. Measurements taken on the surface of an imaginary hemisphere of radius 5 meter centred at the fan indicated a sound pressure of 0,8 Pa.

(16)

Indicate all assumptions made and calculate:

- (i) the sound pressure level on the surface of the hemisphere, and
- (ii) the sound power level of the fan.

[40]

TOTAL MARKS: [100]