



CHAMBER OF MINES OF SOUTH AFRICA

EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL - PAPER 4 SUBJECT CODE: COMMEC4 EXAMINATION DATE: 13 OCTOBER 2017 TIME: 14:30 – 17:30	EXAMINER: R A Rabaji MODERATOR: A R Nundlall TOTAL MARKS: [100] PASS MARK: 60%
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Examination Instructions: FORMULA HANDOUTS ARE ALLOWED

This examination question paper consists of **5** pages

1. Answer all **5** questions in *English*.
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 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 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

QUESTION 1

(1.1) In the context of fire preparedness and prevention in a typical underground workshop, give two examples of each of the following elements of the hierarchy of controls. (10)

- a) Elimination
- b) Substitution
- c) Engineering controls
- d) Administrative controls
- e) Personal Protective Equipment

(1.2) Name six major airborne pollutants emitted from diesel engines, and their respective Occupational Exposure Limits (OELs) (6)

(1.3) The underground workshops on your mine perform regular exhaust checks of diesel equipment before allowing the machines to operate. You are requested to provide a figure for the maximum carbon monoxide emission from the exhaust of a vehicle driven by an 115kW compression ignition engine. The purpose is to ensure that the Occupational Exposure Limit (**OEL**) for CO is not exceeded. The quantity of air used by the engine and released via the exhaust is $0.3\text{m}^3/\text{s}$. Assume that the engine certification requires an airflow rate of $0.075\text{m}^3/\text{s}$ per rated kW of engine power when the engine is clean and running specification and that your mine ventilation system has been designed to achieve this, with no availability of excess air (4)

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QUESTION 2

- (2.1) Describe the four main advantages each of creating an efficient (preferably Computerised) database of occupational hygiene and medical information to: - (8)
- a) The occupational hygienist
 - b) The occupational medical practitioner
 - c) Describe the concepts of distribution of values (normal and log- normal distribution).
Use sketches to support these concepts. (2)
- (2.2) Provide short answers to the following questions (one mark each): (10)
- a) Which part of a report should you write first?
 - b) _____ reports only suggest courses of action.
 - c) The nature of reporting is a _____ communication process, i.e. between the sender and the receiver of the report.
 - d) What should the conclusion of a report be based on?
 - e) What is a footnote?
 - f) For how long must occupational hygiene and medical reports be kept?
 - g) When would you include a foreword or preface in a report?
 - h) How long should an abstract be?
 - i) A _____ is a list of references at the end of a report.
 - j) Most mine plans are prepared using _____ software.

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QUESTION 3

- a) When persons have been exposed to gases or to an oxygen deficiency, certain information must be submitted by the 12.1 appointee at an enquiry held by the Inspector of Mines. List **13 main items** of the information that is usually required? (13)
- b) Give **SEVEN reasons** for abnormally high flammable gas emissions. (7)

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QUESTION 4

- a) You are responsible for determining the ventilation requirement for an underground chamber in which a stationary diesel-powered generator is located. You must provide the minimum amount of fresh air to dilute all gases to the allowable OEL. The local OELs for the various gases are as follows: (8)

CO - 30 ppm
NO - 25 ppm
NO₂ - 3 ppm
CO₂ - 5000 ppm

The quantities of gases produced by the diesel engine are as follows:

CO - 2.0 litres/second
NO - 1.1 litres/second
NO₂ - 0.1 litres/second
CO₂ - 100.0 litres/second

(N.B) Assume that the fresh air you will supply contains no CO, NO, or NO₂ and the concentration of CO₂ in the fresh air is 300 ppm.

- b) Briefly answer the following questions: (2)
- i) In data with a normal distribution, _____ % of the readings are within 2 standard deviations of the mean.
- ii) A _____ is a type of graph with blocks illustrating the distribution of a set of data (determined by tally-stroking).
- c) State the sources and dangers of the following gases (10)
- i) Hydrocyanic Acid Gas
 - ii) Phosgene
 - iii) Aldehydes
 - iv) Chlorine
 - v) Hydrogen Sulphide

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QUESTION 5

- a) A diesel locomotive operates in a haulage and emits $0.2\text{m}^3/\text{s}$ of exhaust gas containing 0.25% carbon monoxide. The cross-sectional area of the haulage is 12.0m^2 and the ventilation quantity is $10.0\text{m}^3/\text{s}$.

Calculate the percentage of carbon monoxide content in the air immediately on the return side of the locomotive when:

- i) The locomotive is standing still.
 - ii) The locomotive is travelling 2.5km/h in the same direction as the ventilation.
 - iii) The locomotive is travelling 8km/h opposite the direction to the ventilation.
- (15)

- b) List any five steps of conducting an effective risk assessment. (5)

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TOTAL MARKS: 100