



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: COMMEC EXAMINATION DATE: 12 MAY 2017 TIME: 14:30 – 17:30	EXAMINER: JC Maass MODERATOR: AR Nundlall TOTAL MARKS: [100] PASS MARK: 60%
NUMBER OF PAGES 5	
<u>Examination Instructions:</u> This examination question paper consists of 5 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	

QUESTION 1. Risk Management

- 1.1. List **five** of the expected duties of employers with respect to Risk Management in terms of the Mine Health and Safety Act. (5)
- 1.2. Briefly explain the meaning or definition of the following phrases or words used for Risk Management. (6)
- a) Hazard:
 - b) Risk:
 - c) Incident:
 - d) Legal Liability:
 - e) Occupational:
 - f) Consequence:
- 1.3. Name the **four** fundamental steps of the Risk Management Process **and** give one example of an outcome of each step. (4)
- 1.4. The approach to risk measurement should not be complicated and be sufficient so far as it is reasonable practicable. Briefly explain the approach to risk management by completing the sentence for the words below: (4)
- a) Allow:
 - b) Have:
 - c) Communicate:
 - d) Demonstrate:
- 1.5. You should consider the Risk Management principles of consequence and frequency when required to prioritise the Major Risks related to Environmental Engineering and Occupational Health at your mine. (6)
- a) Give **four** examples of Major risks that may seriously compromise the Health or Safety of the workforce almost immediately or **short term**:
 - b) Give **two** examples of Major risks that may seriously compromise the Health or Safety of the workforce in the medium to **long term**:

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QUESTION 2. Information Management and Statistics

- 2.1. In business correspondence, as in the case for all good report writing, a simplistic and straightforward approach is the best way to go. The message or information you want to get across must however not be lost in too much simplicity. (5)
- Briefly explain the concept of “Think before you write” by completing the sentences below:
- a) Think of the reader:
 - b) Think of the reason:
 - c) Think of the facts:
 - d) Think of the person:
 - e) Think of the follow-up:
- 2.2. The Terms of Reference or Objectives dictate which types of report are required. Name **and** briefly explain the **four** types of reports: (4)
- 2.3. The objectives of reporting must also satisfy the reasons for reporting. A major task of the Environmental Engineering and/or Occupational Hygiene department is to collect, record, and report on the health and safety conditions that exist on their mines, in terms of section 12 of the MHSA. (6)
- List **and** briefly explain **six** reasons for reports and reporting:
- 2.4. 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. (5)
- 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:
- 2.5. List **and** briefly explain the **five** actions to be taken by you as a mine official, if employees are working in or near a dangerous workplace and who can be immediately affected: (5)

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QUESTION 3. Fires and Explosions

- 3.1. Define the following terms, briefly explain in your own words: (5)
- a) Products of combustion (pyrolysis):
 - b) Heat contribution:
 - c) Smoke density:
 - d) Flash ignition temperature:
 - e) Self-ignition temperature:
- 3.2. Fires are grouped into various classes to rationalise the choice between the extinguishing mediums and devices for fire-fighting purposes. (8)
- Name the classes below, with at least **two** examples of each **and** the special precautions to be taken when extinguishing these types of fires.
- a) Class A: (2)
 - b) Class B: (3)
 - c) Class C: (3)
- 3.3. Give an approximate flash-point temperature of the following products **and** the approximate volumes of carbon monoxide (CO) and carbon dioxide (CO₂) gases produced when burning: (6)
- a) Wood:
 - b) High Density Polyethylene (HDPE):
 - c) Polyvinylchloride (PVC):
- 3.4. Speed of response is essential during fire-fighting operations. Once a fire has been reported and confirmed, the organisation of the fire-fighting operations must be started immediately. (4)
- List **and** briefly explain the **four** primary duties of the first senior official (usually the manager) in the Emergency Control room:
- 3.5. List **four** of the key personnel that should be in the Emergency Control room as part of the core control team, other than the Manager in charge, section manager and mine overseer: (2)

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QUESTION 4. Gases

- 4.1. List and briefly explain **five** of the main recognised methods to prevent a coal dust explosion in a mine. (5)
- 4.2. List and briefly explain **seven** precautions to be taken or the positions when testing for flammable gas in a force / exhaust overlap ventilation system. (7)
- 4.3. The total volume of a sealed off section of a mine is 20 000 m³/s and consists of an atmosphere containing 80% methane. The pressure inside and outside the sealed area is 98 kPa. The starting of a nearby booster fan lowers the pressure outside the seal to 1.5 kPa. (8)
- a) If the resistance of the leakage path around the seal is 150 000 Ns²/m⁸, calculate at what rate the methane / air mixture inside the sealed section will start to flow around the seal? (2)
 - b) If the airway alongside the seal has an airflow of 10 m³/s containing no methane, what will be the methane percentage in the air stream on the return side of the seal immediately after starting up the fan? (3)
 - c) Because the methane / air mixture flows out around the seal, the pressure inside the seal will eventually be equal to the new pressure outside the seal and the flow will stop. What total will be the volume of methane / air displaced from the sealed area, before the flow stops? (3)
- 4.4. You are requested by the engineering department on your mine to calculate the maximum carbon monoxide emission from the exhaust of a vehicle driven by a 72 kW compression ignition engine (diesel). The purpose is to ensure that the time weighted average exposure over an 8 hour shift (**TWA**), for CO is not exceeded, when operated in uncontaminated intake air. (5)
- The quantity of air used by the machine and released via the exhaust is 0.2 m³/s. Assume a clean airflow rate of 0.1 m³/s per kW of engine power.
- a) The required clean airflow rate for the operation of the engine. (1)
 - b) The maximum CO release rate at the exhaust of the engine in m³/s. (4)

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TOTAL MARKS 100