

Minerals Council South Africa

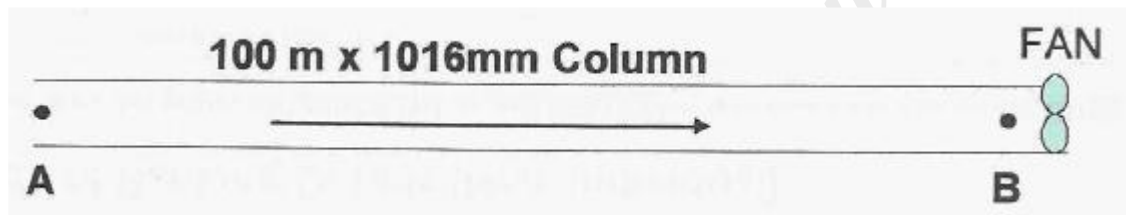


EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 1 - FLOW DYNAMICS, AIRFLOW, FANS, MINE WATER SUBJECT CODE: COMMEC1 EXAMINATION DATE: 05 MAY 2025 TIME: 14:00 – 17:00	EXAMINER: Tsietso B Letanta MODERATOR: Eugene Botha TOTAL MARKS: [100] PASS MARK: (60%)
NUMBER OF PAGES: 8 (including this page)	
SPECIAL REQUIREMENTS: <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> THIS IS NOT AN OPEN BOOK EXAMINATION. INSTRUCTIONS TO CANDIDATES: 1. Answer all 4 questions 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 <u>and check calculations on which your answers are based.</u> 4. Hand-held electronic calculators may be used for calculations only. 5. Write in ink on the <u>right hand page</u> only – <u>left hand page will not be marked.</u> 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. 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 <u>NOT</u> allowed in the examination room. <u>Only Calculators</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 Describe 3 different ways which may be used to determine fan total pressure (FTP). Illustrate your answer with sketches indicating how these methods may be used. (15)
- 1.2 You are considering using a shaft sinking column made of new material, and the manufacturer claims an exceptionally low friction factor (k). You arrange for a fan to be mounted at the exit end of a 100 m length of this new ducting, which is 1016mm in diameter. (10)

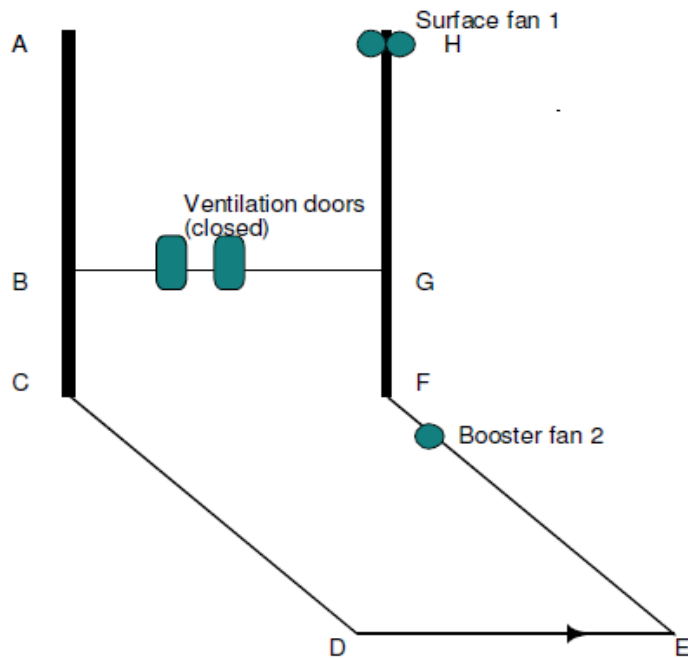


After the test is run, the following data are reported to you:

- Side tube reading just inside the test column entry (A) -275Pa
- Facing tube reading at the end of the test column (B) -513Pa
- Quantity of air flowing through test column $14\text{m}^3/\text{s}$
- Air density $0.98\text{kg}/\text{m}^3$

Determine the k factor for the test column corresponding to these data, and comment on your answer (10)

[25]

QUESTION 2

In the airway shown above, Fan 1 is on the surface, and the fan air inlet density is 0.9kg/m^3 . Fan 2 is underground where the air density is 1.2 kg/m^3 . There is no leakage, and natural ventilation effects can be ignored. The table below depicts measured pressure losses and mean densities for both fans.

Tunnels	Measured pressure loss (kPa)	Mean density (kg/m^3)
A-B	0,667	1,00
B-C	0,830	1,15
C-D	0,403	1,21
D-E	0,934	1,20
E-F	0,667	1,20
F-G	1,445	1,13
GH	1,160	0,95

- 2.1 **Use the fan curves worksheet that is supplied with this question paper** to plot the system resistance curves and return the completed fan curve worksheet with your answer sheet. (Please only write in your identity number/passport number on the worksheet). (4)

- 2.2 If the measured volume and pressure at Fan 1 is $100\text{m}^3/\text{s}$ at 3kPa , determine the booster fan pressure and volume measured at Fan 2. (7)
- 2.3 If Fan 1 operates alone and densities do not change, what will be the pressure at the ventilation doors and volume at Fan 1? (9)
- 2.4 If Fan 2 operates alone and densities do not change, what will be the pressure and volume measured at Fan 2? (9)
- 2.5 Ignoring the effect of air density, what will be the approximate pressure difference across the doors between B and G with both fans running? (5)
- [34]**

QUESTION 3

Water is pumped at an average rate of 13.0 Mega Litres (Mlt) per day to the surface from the main pump station 1 800m below the surface. The amount of fissure water entering the mine is equivalent to 0.4 tons per ton of rock broken.

- 3.1 The total rock broken is 200,000 tons per month. Assuming a 30-day month, what is the service water usage in tons per ton broken? (3)
- 3.2 If the mine pumps water for 24 hours every day:
- i) What size pipe would be used? (Assume standard sizes)? State any assumptions made. (Hint: Make use of the chart provided). (2)
 - ii) Using the pipe size determined above, what is the pump shaft power (pump input power) required? Assume a pump efficiency of 70% (5)
- 3.3 The electrical supply contract with an electricity provider allows the mine to pump for only 19 hours per day to displace the volume of water calculated in 3.2 above:
- i) Assuming standard sizes, what size pipe would you use? Give reasons for your answer. (2)
 - ii) Using the pipe size as determined above, what is the pump shaft power (pump input power) required? Assume a pump efficiency of 70%. (5)

- iii) If the average electricity cost is 129 cents per kWh with no daily variations what is the annual electricity cost for pumping 24 hours per day? (2)
- iv) If the average electricity cost is 129 cents per kWh with no daily variations what is the annual electricity cost for pumping 19 hours per day? (2)

3.4 Define terminal velocity (2)

[23]

QUESTION 4

- 4.1 What are the advantages and disadvantages of the gas tracer method when determining velocities or quantities? (3)
- 4.2 With the aid of a sketch, describe the principle of operation of a 4-gate system used when ventilating the development of a vertical shaft. (6)
- 4.3 What are the disadvantages of the exhaust overlap system when multi-blasting? (3)
- 4.4 Mention any six methods of controlling the performance of an axial flow fan. (6)

[18]

TOTAL MARKS: [100]

NB: Include this sheet in your answer book.

