Chamber of Mines of South Africa

EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA: INTERMEDIATE CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 1 **SUBJECT CODE: COMIMEC1** **EXAMINATION DATE: 13 OCTOBER 2017** **TIME**: 14:30 – 17:30	**Examiner:** Mervin van Rooyen **Moderator:** Inus Labuschagne **TOTAL MARKS:** [100] **PASS MARK:** [60%]

NUMBER OF PAGES: 4

SPECIAL REQUIREMENTS:

THIS IS **NOT** AN OPEN BOOK EXAMINATION. THERE IS NO FORMULA HANDOUT

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

In Addition to the legal duties and appointments [(Regulation 5.1(1), 9.2(3) and 16.1(1)], normal work of the department entails?

[10]

QUESTION 2

2.1 List the main causes of underground fires. (6)

2.2 List the main causes of surface fires. (4)

2.3 What forms an integral part of the mine escape strategy of a mine and describe what minimum requirement they should comply to? (4)

2.4 What factors are essential to an effective escape strategy? (3)

2.5 What is the role of an Early Warning device within the work place? (3)

[20]

QUESTION 3

3.1 What is the pressure loss when air at a velocity of 16.0m/s flows along a galvanised duct that has a friction factor of $0.004Ns^2/m^4$, a length of 350m and diameter of 610mm, the density is $0.93kg/m^3$? (10)

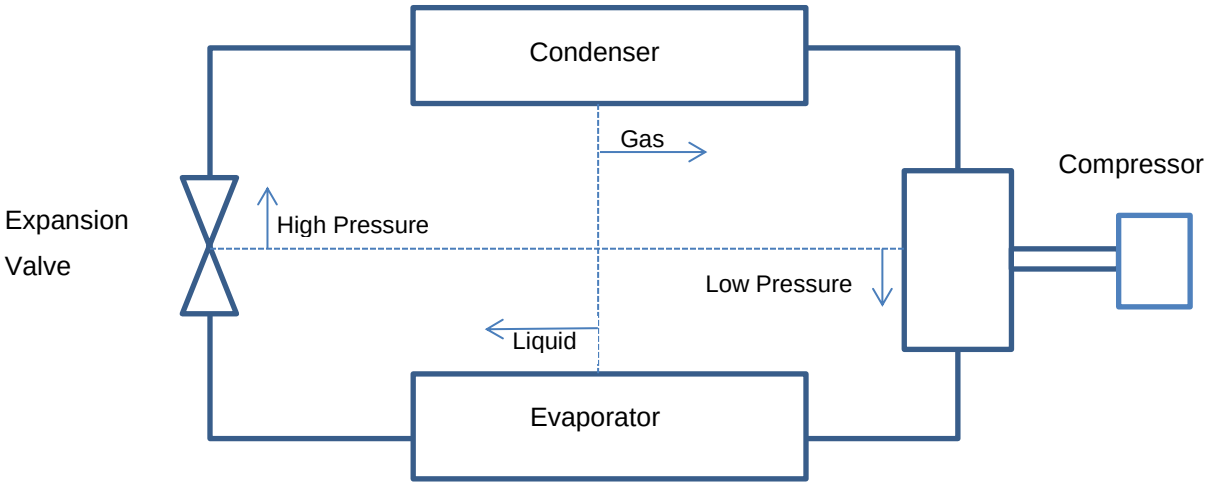
3.2 Calculate the friction factor of a haulage in which $57.2m^3/s$ flow at a pressure loss of 250pa. The length of the haulage is 170m and is 2.5m x 3.0m. The prevailing density is $1.15kg/m^3$. Is this a rock lined or heavy supported airway? (10)

[20]

(2)

QUESTION 4

4.1 Sketch a Vapour Compression Refrigeration Cycle. Label all components and associated information of a typical refrigeration plant. (8)



4.2 List the function of each main component of the Vapour Compression Refrigeration Cycle (12)

[20]

QUESTION 5

5.1 The following figures were obtained from a fan test conducted on a direct driven axial flow fan:

Fan speed: 15.5 r/s
Air density: 1.012 kg/m^3

Quantity (m3/s)	Pressure (Pa)	Input Power (kW)
0	930	3.6
2	840	4.6
4	870	5.9
6	910	7.8
8	860	10.0
10	730	12.4
12	490	14.7
13	310	15.0
14	0	14.6

From these figures draw a complete fan performance curve, including power and efficiency curves.

Determine the fan operating point, input power and efficiency of this fan if it is installed in a 760mm galvanised, 54m long, having a frictional factor of 0.0035 Ns/m^8 at a prevailing density of 1.012kg/m^3.

Fan performance curve

- Plot Quantity on (horizontal or x-axis) against pressure (vertical or y-axis)
- Plot quantity against input power (y-axis) on right side of graph

(6)

5.2 From the above table, draw the efficiency curve by plotting the quantity (x-axis) against the (y-axis) on the same graph paper.
The fan is to be installed in a 760mm galvanised, 54m long, having a frictional factor of 0.0035 Ns/m^8 at a prevailing density of 1.012kg/m^3. The system resistance can now be calculated:

$$R = \frac{KCL}{A^3}$$

(Note w/1.2 was not included as both the fan and system density are at a density of 1.012 kg/m^3)

Calculate the points on the graph for the system resistance curve, use $P = RQ^2$

(6)

Q	2	4	6	8	10	12	14
R	4.85	4.85	4.85	4.85	4.85	4.85	4.85
P							

From the above table, draw the efficiency curve by plotting the quantity (x-axis) against the (y-axis) on the same graph paper.

Read off the Fan Operating Point (FOP) from the graph.
System resistance curve intersects the fan characteristic curve.

Pressure = 610 Pa
Quantity = 11.2 m^3/s

Read off the Fan efficiency from the quantity line intersection of the Efficiency curve on the right hand efficiency scale.
Efficiency = 49 %

Read off the Input power of the fan, from the quantity line vertically up till it intersects the power curve on the right hand power scale.
Input power = 13.8 Kw

(18)
[30]

TOTAL MARKS: [100]