MINE MANAGER'S CERTIFICATE OF COMPETENCY EXAMINATION

METAL MINING II

MINING TECHNICAL SERVICES

DATE: 19 OCTOBER 2011

TOTAL MARKS: 100

TO PASS: 50

**TIME ALLOWED:** 3 HOURS

(08h30 to 11h30)

NOTE:

- This question paper consists of **SIX** pages
- All questions must be answered.
- All answers and sketches to be presented in a neat and decipherable manner. Papers will not be marked if not decipherable.
- Restrict the use of highlighters.
- Do not use a red pen.
- Read the instructions on the front page of your answer book carefully.
- No cellular phones shall be allowed in the examination venue.

QUESTION 1

You receive a call from a Mine Overseer who explains that he has insufficient ventilation at a development end which falls in his area of responsibility. He assumes there is something wrong with the fan and column that has been installed. You arrange for a pressure survey to be conducted and the following readings were taken of the column at regular intervals;

A	B	C	D	E	F	G	H
1500Pa	1325Pa	1150Pa	975Pa	725Pa	350Pa	175Pa	0Pa
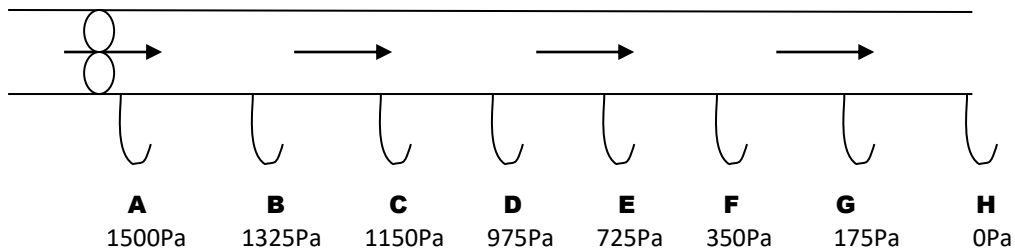
1.1 What would you deduce from these readings and what advice will you give the Mine Overseer? (5)

1.2 Describe the 5 Elementary Laws of Airflow (5)

1.3 The diagram below shows 4 converging airways.

   a) Is the air moving from A to B or from B to A?
   b) Is the air moving from A to C or from C to A?
   c) Is the air moving from A to D or from D to A?
   d) Is the air moving from A to E or from E to A and also explain why? (5)
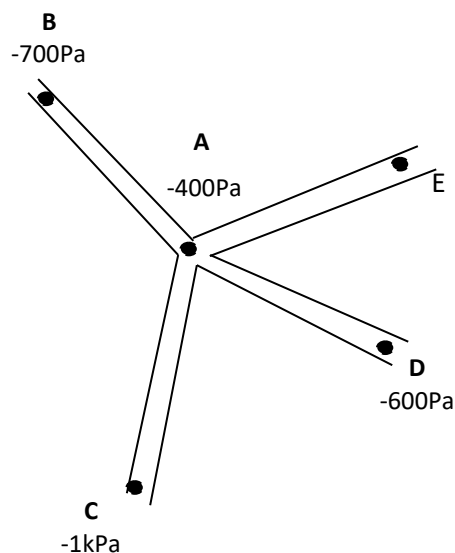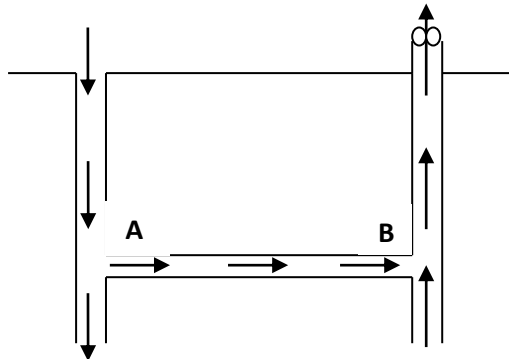

1.4 The diagram below depicts a haulage in a gold mine. The haulage has a resistance of 0.135Ns²/m⁸ and allows 125m³/s of ventilation to pass through it to the upcast shaft. The air density in the haulage is 1.3kg/m³, measures 3.5m x 2.8m and has a friction factor of 0.017Ns²/m⁴.

Calculate the following;

1.4.1 The length of this haulage,

1.4.2 The pressure difference in the haulage. (5)

[20]

QUESTION 2

2.1 A new mine is planning for the next financial year to have 32 development ends in operation. They further determine (by means of a risk assessment) that due to the anticipated flammable gas levels they will have to ventilate all these ends with force – exhaust overlap systems. They decided to use 22 kW force fans and 45kW exhaust fans. If power cost is 16c per kW/hour, determine the annual running cost of all the fans. Assume the fans run continuously 24/7. (5)

2.2 When air flows inside a duct there are number factors that cause resistance to airflow. One of these factors is shock losses, what are shock losses? (2)

2.3 The sketch below indicates various means of measuring pressures on a duct. What pressure is A, B and C measuring? (3)
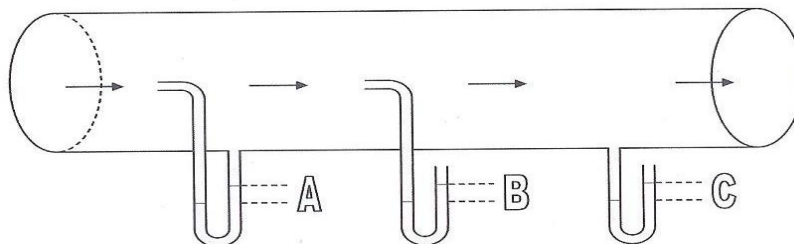
2.4 The diagram illustrates the Vapour Compression Refrigeration Cycle. In your answer book write down what each or these labels (from a to h) are. Note that

only the terms are required and that there is no need to reproduce the sketch.

(4)

a)

b)

c)

d)

e)

f)

g)

h)
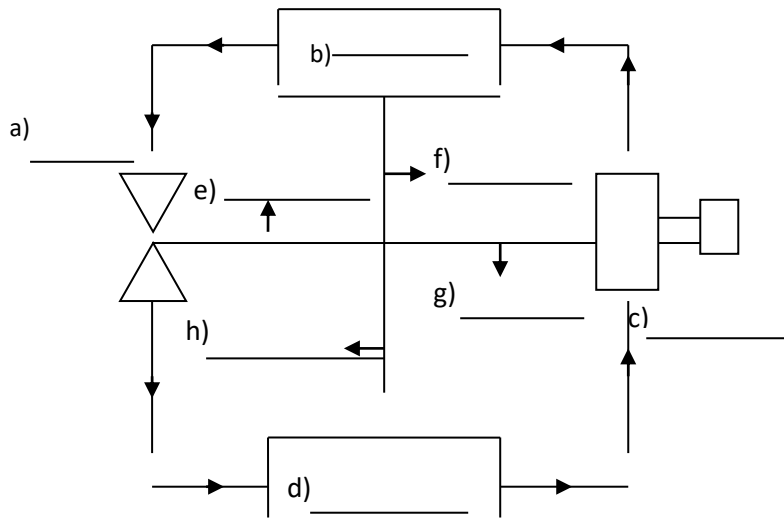
2.5 Calculate the mass flow of air flowing through a 760mm duct if the velocity pressure measured (by means of a Pitot tube) is 140Pa. The air density is 1.08kg/m³. (6)

[20]

QUESTION 3

3.1 Name the three main processes of heat transfer and give a practical example of each. (3)

3.2 Give five hazards of over exposure to heat stress and briefly explain each condition. (5)

3.3 Briefly describe the term "Heat Tolerance Screening" as part of the Heat Stress Management Process. State the control conditions. (5)

3.4 Define and give the formula with units for Boyle's Law. (3)

3.5 List three ways in which hazardous chemical substances can enter the human body. (3)

3.6 Define Asbestosis. (1)

[20]

QUESTION 4

The Geologist has informed you that two prominent joints run along the length of the hanging wall of the excavation and intersect to create a wedge as shown below. Recommend a support system to prevent the wedge from collapsing into the excavation.
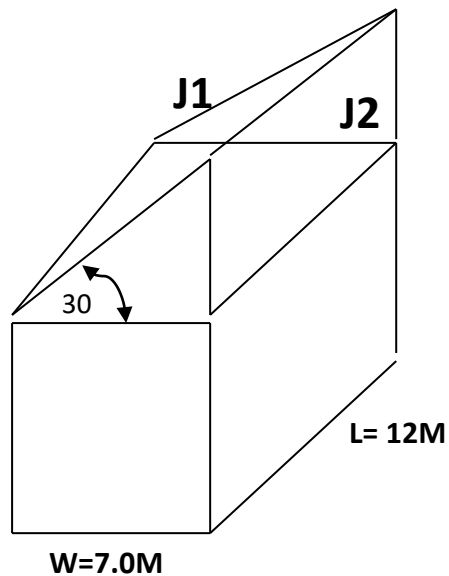
4.1 Calculate the potential mass of the wedge if the rock density is 1000kg/m³.(4)

4.2 Determine the required support resistance using a safety factor of 1.6 Gravity can be assumed as 9.81 m/s². (4)

4.3 Using standard 38 ton cable anchors, determine the number of anchors required to support the wedge. (4)

4.4 What minimum length of anchor would you recommend? Motivate your answer. (4)

4.5 Determine the spacing of the anchors to ensure even loading? (4)

[20]

QUESTION 5

A mine records the following results:-

Stope value	14,54 g/t
Underground sorting	7% at 2,0 g/t
Trammed from stoping	184 000t
Reclamation	8000t at 9,30 g/t
Development	18 000t at 5,20 g/t
Surface sorting	8% at 0,12 g/t
Tons milled	200 000
Stope width	120 cm
Density	3,0 t/m³
Mine call factor	92%
Profit	R16 214 996.00
Working cost	R41/ t milled
Gold Price	R 9000/kg

Calculate:-

5.1   Tonnage discrepancy   (10)

5.2   Percentage recovery   (10)

                                                                                [20]

                           TOTAL MARKS: [100]