

**Northern Invitational Mine Rescue Contest  
Batavia, New York  
September 18, 1998**



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**PROBLEM SOLUTION**

\*Note: the problem involves a bituminous coal header fire, caused by a battery short circuit on an LHD while firing a face shot, and the subsequent entrapment of an employee. The teams will be required to seal the fire, re-ventilate the mine prior to entering the barricade, administer first aid to the victim, and pump water before bringing the injured miner to the surface. Methane has been included in the problem, but will not exceed 0.8%.

\*Note: the team map designates the first crosscut between ENTRY 2 and ENTRY 3 as the X-CUT 1. However, the first crosscut between ENTRY 1 and ENTRY 2 does not have a designation. Since the crosscuts are staggered in this mine, for descriptive purposes in this problem solution (see attachment 1 - Answer Map), the crosscut will be designated as a continuation of X-CUT 1. The same logic applies to the remaining two crosscuts between ENTRY 1 and ENTRY 2. That is, these crosscuts will be designated as X-CUT 2 and X-CUT 3.\*

1. The team captain introduces the team to the official in charge (mine manager). The mine manager then introduces himself and the field judges, reads the problem orientation sheet, and answers the team's questions.

When the team verifies that they understand the instructions, the mine manager will provide the captain and fresh air base attendant each with a copy of the team briefing statement, mine information sheet, and team mine map (attachments 2 - 4). The captain immediately starts the official clock. He writes the month, day, year, and the team position number on the sign-in board. **[Applicable Contest Rules: Judge 1 - Surf 8]**

2. After starting the clock, the team discusses the conditions presented by the problem and the map. The team then checks all the equipment to be used to work the problem and goes under oxygen. \*Note: the lifeline signals must be presented to the lifeline judge.\* **[Judge 1 - Surf 1-7, + 9]**  
**[Judge 2 - Surf 1-5] [Judge 3 - Surf 1]**
3. When ready, the team must examine the mine openings. The first stop should be the # 2 SERVICE SHAFT (intake). Here, the team will find that the air is clear (placard A). \*Note: see page 6 for placard gas concentrations.\* The conveyance will be at the top of the shaft and the team will place combustible material on the cage and send it down, using the posted Nevada hoist signal codes. The team must then signal the cage to return to the surface. \*Note: the No. 1 Judge will allow 10 seconds for the cage to get to the bottom, and 10 seconds more to return to the top.\* The combustible material will be intact and dry. **[Judge 1 - UG 3] [Judge 2 - UG 1]**

4. The second stop must be the # 1 PRODUCTION SHAFT (exhaust). \*Note: the team must perform an apparatus and personnel check before entering smoke, since the team briefing statement had stated that there was heavy black smoke exiting this shaft.\* At the shaft, they find light smoke with 20.0% O<sub>2</sub>, 6000 ppm CO, 0.4% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, 540 ppm SO<sub>2</sub> (placard B). \*Note: this is the first indication that an explosive gas (methane) has been encountered in the non-gassy mine. The team should notify the mine manager that methane was found in the air exhausting from this shaft. In addition, because of the presence of methane in the mine, the team must use non-sparking tools to work the problem. If the team does not have non-sparking tools, the captain must ask the mine manager to provide them. Further, if the team asks for additional gas detectors, the mine manager can supply Dräger stain tubes for SO<sub>2</sub> and other gases.\* **[Judge 1 - UG 8b.2 + 10] [Judge 2 - UG 1] [Judge 3 - UG 15]**

The conveyance will be at the top of the shaft and the team can place combustible material on the cage and signal it down. \*Note: again using the posted Nevada hoist signals and Judge 1 allowing 10 seconds down and 10 seconds for return.\* When the material is checked, it will be intact and wet. The team may attempt to determine the depth of the water on the cage. The response from the No. 1 Judge will be that it cannot be determined at this time. \*Note: if the team asks about the status of the surface water pump, the No. 1 Judge will inform them that it is still under repair.\* **[Judge 1 - UG 3] [Judge 2 - UG 1]**

5. The team is now ready to enter the mine. The team should then enter the mine via the # 2 SERVICE SHAFT (intake). Once in the mine, the team must make their 50 feet check at the first stop along ENTRY 3. They will encounter clear air (placard A), water ankle deep, brattice material (two sets), a power center, and a portable pump with 200 feet of power cable and discharge line attached. A permanent stopping is located in X-CUT 1 to the left. \*Note: as per team briefing statement, all electrical power in the mine is off. Power has only been restored to the shafts and main fan.\* **[Judge 1 - UG 4b.1, 4d, + 6] [Judge 3 - Surf 4 + 5 and UG 5]**

\*Note: after the first 50 feet apparatus check, the team must stop at 20-minute intervals to examine their apparatuses.\* **[Judge 1 - UG 12]**

\*Note: while underground, the team must make gas checks at face areas and stoppings. When stops are made at the openings of crosscuts, rooms, or drifts turned off the drift that is being traveled, separate gas tests shall be made rib to rib across each entry and at each opening to places turned off the entry. No place shall be passed without first checking the condition of that place.\* **[Judge 2 - UG 1]**

\*Note: during exploration of the mine, the team captain must verbally indicate that he/she is checking the back or roof: 1) at intersections, shaft stations, rooms, faces, and mine openings; 2) at all points of furthest advance; 3) before building or erecting any structure; 4) upon passing through any barricade, stopping, bulkhead, air lock, door, check curtain, or similar barrier; and 5) at the location of fire or intense heat.\* **[Judge 1 - UG 4b]**

\*Note: team captain must also mark the date and his/her initials at the point of furthest advance of the team in any direction such as at stoppings, faces of rooms and drifts, water over knee deep, impassable falls, barricades, fires out of control, and at locations of any live persons or bodies.\*  
**[Judge 1 - UG 5]**

\*Note: at all times the team must travel at normal walking speed.\* **[Judge 2 - UG 4]**

6. The team advances to X-CUT 2 where they will find clear air (placard A), a permanent stopping with the door closed, and a telephone. When they check the phone, the mine manager will respond to their questions. \*Note: the team cannot advance beyond 3 feet past the second crosscut, because they have not tied in the entries behind them.\* At this time, they must airlock before opening the closed door to enter and explore ENTRY 2. \*Note: if the team does not airlock, then this constitutes a major ventilation change that was made without knowing the affect that it may have had on unexplored areas.\* **[Judge 1 - UG 9] [ Judge 2 - UG 7 + 10]**
7. When the team airlocks and proceeds through the door, they will enter heavy smoke with 20% O<sub>2</sub>, 6000 ppm CO, 0.6% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 540 ppm SO<sub>2</sub> (placard D). The team must make a check immediately before entering the smoke. The team can then explore ENTRY 2 and ENTRY 1 back to the # 1 PRODUCTION SHAFT. **[Judge 1 - UG 10] [Judge 3 - UG 5]**
8. In ENTRY 2, they will find an LHD on charge and two battery chargers. At the dinner hole, the team will find a placard which reads a table and four chairs along with a miner's lunch bucket that contains a note stating: "I couldn't get the phones or cage to work, I'm barricading in. Please help me." The environmental conditions in this area will be light smoke with 20% O<sub>2</sub>, 6000 ppm CO, 0.4% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 540 ppm SO<sub>2</sub> (placard B).
9. When proceeding through X-CUT 1 between ENTRY 2 and ENTRY 1, the team will find a damaged stopping with the regulator missing. The environmental conditions beyond this crosscut will be light smoke with 20% O<sub>2</sub>, 6000 ppm CO, 0.4% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 540 ppm SO<sub>2</sub> (placard B). In the supply hole, the team will map various supplies, including brattice material (1 set), four posts, two empty oil buckets, a piece of rope, and a telephone. \*Note: the telephone in the supply hole is broken and cannot be repaired. If the team needs to call outside, they will have to use the telephone located in ENTRY 1.\* At the bottom of the # 1 PRODUCTION SHAFT, they will find water ankle deep. \*Note: the team cannot advance 3 feet beyond the second crosscut in ENTRY 1, because the # 1 PRODUCTION SHAFT has not been explored and tied in. Therefore, to accomplish this, the team must exit the mine via the #2 SERVICE SHAFT.\* **[Judge 1 - UG 9]**
10. Before entering the # 1 PRODUCTION SHAFT, the team must again make an apparatus and personnel check prior to entering the smoke. Once the team rides the conveyance to the bottom, they have now tied in the first two crosscuts and the shafts. At this time, they can continue exploring the mine. **[Judge 1 - UG 4d + 10]**

11. Advancing along ENTRY 1, the team will encounter the check curtain located to the right and the barricade located to the left in X-CUT 2. The air in front of the barricade will be: light smoke with 20.0% O<sub>2</sub>, 6000 ppm CO, 0.4% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, 540 ppm SO<sub>2</sub> (placard B). The victim will be responsive and will indicate to the team his condition. The team will inform him that they must clear the air before opening the barricade and will be back shortly to rescue him. They can continue to explore ENTRY 1 to the last open crosscut. They will find water ankle deep in X-CUT 3 to the left and the roof bolting machine to the right. Environmental conditions in this intersection will be: heavy smoke with 20% O<sub>2</sub>, 6000 ppm CO, 0.6% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 540 ppm SO<sub>2</sub> (placard D). \*Note: the team cannot travel 3 feet past the corner into the face of ENTRY 1 at this point, unless they have tied in the crosscuts behind them.\*  
**[Judge 1 - UG 9]**
  
12. As the team advances, the captain will warn the team as he/she locates the loose roof in ENTRY 2. They will then encounter intense heat in X-CUT 3 between ENTRY 2 and ENTRY 3. Environmental conditions in this intersection will be: heavy smoke with 20% O<sub>2</sub>, 7000 ppm CO, 0.8% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 600 ppm SO<sub>2</sub> (placard E). The team must seal this side of the fire and leave a portion of the seal open to act as a regulator. In order to obtain brattice material for the seal, the team must retreat to the supply hole in ENTRY 1. \*Note: as the team retreats, the rear captain must warn the team that they are passing the loose roof.\* If the team performs any travel other than described, this will be considered undue delay. **[Judge 1 - UG 4a + 11]**  
  
\*Note: if the team chooses to proceed through the door in the stopping between ENTRY 2 and ENTRY 3 and retrieve the brattice material that was used for the airlock, they cannot pass back through the door without another airlock. If they do, this is a major ventilation change without knowing the affects on unexplored areas. Additionally, wasting time to construct a second airlock will be considered undue delay.\* **[Judge 1 - UG 11] [Judge 2 - UG 6]**
  
13. At this time, the team must, without undue delay, find all other approaches to the fire. The team should proceed through the door in the stopping between ENTRY 2 and ENTRY 3. They must close the door behind them and tear down the airlock. They can now advance to X-CUT 3 in ENTRY 3. Along the way, they will encounter: light smoke with 20% O<sub>2</sub>, 4000 ppm CO, 0.4% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 400 ppm SO<sub>2</sub> (placard C). \*Note: again, the team will be leaving clear air and entering smoke, therefore, they must make an apparatus and personnel check.\* **[Judge 1 - UG 10 + 11]**
  
14. In X-CUT 3, they will find two bodies, an LHD with a charred battery, and two used fire extinguishers. \*Note: the team must perform a primary assessment of both bodies before an indication of death can be determined.\* They will also discover a shot wire that was hooked to the battery, and they must shunt the ends of the wire. When the team checks across ENTRY 3, adjacent to the inby corner of X-CUT 3, they will encounter heavy smoke with 20% O<sub>2</sub>, 7000 ppm CO, 0.8% CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 600 ppm SO<sub>2</sub> (placard E). The team must then seal this side of the fire (with a regulator), without undue delay. **[Judge 1 - UG 11] [Judge 3 - UG 2 +7]**

15. Once the fire has been sealed with a regulator on both sides, the team must complete their systematic exploration of the mine. When the team advances into the face of ENTRY 3 they will encounter water knee deep. They must travel through the water and map the face shot and loose roof. **[Judge 1 - UG 4a + 9]**
16. The team can then retreat to ENTRY 1 and finish exploring the face area to complete their exploration activities. \*Note: the face of ENTRY 1 has water knee deep and the team can explore the face in its entirety.\* **[Judge 1 - UG 9]**
17. Once all areas have been explored, the re-ventilation of the mine can be accomplished. To properly re-ventilate, the team must:
- 1) rebuild the damaged stopping in X-CUT 1 between ENTRY 1 and ENTRY 2;
  - 2) open the door in the stopping between ENTRY 2 and ENTRY 3; and
  - 3) ask the fresh air base to turn the main fan on.
- \*Note: if the team completes these requirements, the fan can be restarted and the air in front of the barricade will slowly clear. The placards located outside of the barricade and at the #1 PRODUCTION SHAFT (return) can be flipped over to indicate: light smoke with 20.8% O<sub>2</sub>, 2000 ppm CO, 0.2 % CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 300 ppm SO<sub>2</sub>.\* **[Judge 2 - UG 10]**
- \*Note: if the team fails to open the door in the stopping between ENTRY 2 and ENTRY 3, then the air passes through the fire seals and the gases outside the barricade do not change.
- \*Note: if the team opens the door in the stopping between ENTRY 2 and ENTRY 3 and fails to rebuild the partial stopping in X-CUT 1 between ENTRY 1 and ENTRY 2, then the air is short-circuited, and will not be cleared in front of the barricade.\*
18. After re-ventilating, the gas concentrations will be lowered to acceptable levels and the team can enter the barricade. After a primary and secondary survey of the injured victim, the team will be handed a placard which reads:
- The patient is experiencing severe pain with each breath, and is unable to breathe deeply. An area in the middle of the patient's left side is extremely tender, and the left abdominal area is swollen, tender, rigid, and bruised. Frothy blood is oozing from the patient's mouth. The pulse is weak and rapid, breathing is shallow, and the skin is cold and clammy.*
- The symptoms indicate that the victim was suffering from internal bleeding and a rib fracture. Before transporting the patient, the team must properly administer first aid. To remove the patient from the mine, the person must also be fitted with an apparatus and secured to the stretcher. **[Judge 3 - UG 1, 2, 9, 10, 12 + 14]**
19. When traveling out of the mine with the injured person, the ankle deep water at the shaft bottoms will be changed to over knee deep. \*Note: this applies to either shaft.\* The team must retreat to the working phone in X-CUT 1 between ENTRY 2 and ENTRY 3, call outside, and request that the

pump be turned on. The surface pump has now been repaired and can be activated. When the team returns to the shaft bottom, the water will be pumped to ankle deep. The team can then continue to the surface. \*Note: in order to preserve their lifeline, the team must leave the mine via the #1 PRODUCTION SHAFT, since this is their last route of entry into the mine. [Judge 1 - UG 8a.2] [Judge 3 - Surf 5 and UG 5 + 9]

**THE END**

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### **Key to Gas Placards:**

**A** - 20.8 % O<sub>2</sub>, 3 ppm CO, 0.0 % CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, and 0 ppm SO<sub>2</sub>  
(Clear Air)

**B** - 20.0 % O<sub>2</sub>, 6000 ppm CO, 0.4 % CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, 540 ppm SO<sub>2</sub>  
(Light Smoke)

**C** - 20.0 % O<sub>2</sub>, 4000 ppm CO, 0.4 % CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, 400 ppm SO<sub>2</sub>  
(Light Smoke)

**D** - 20.0 % O<sub>2</sub>, 6000 ppm CO, 0.6 % CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, 540 ppm SO<sub>2</sub>  
(Heavy Smoke)

**E** - 20.0 % O<sub>2</sub>, 7000 ppm CO, 0.8 % CH<sub>4</sub>, 0 ppm NO<sub>2</sub>, 600 ppm SO<sub>2</sub>  
(Heavy Smoke)

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**No Answer Map is available at this time.**



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**TEAM BRIEFING STATEMENT**

You are located on the surface of the Fosdenk Clay Company's September Song Mine. The mine is a single-level underground mine opened by two shafts 400 feet deep. The # 1 PRODUCTION SHAFT is the exhaust shaft and is used for hoisting ore from the mine, and as the emergency escape way. The # 2 SERVICE SHAFT is the intake shaft and is used to transport people and supplies. High-grade clay is mined by the room and pillar method. The entries are initially driven approximately six to seven feet high and ten to twelve feet wide. A bituminous coal header, twelve to eighteen inches thick, borders the roof, and is supported by eight foot roof bolts. The roof is fairly competent, but coal sluffage occasionally occurs and may be additionally supported by wooden posts.

This afternoon, the foreman and two crew members worked over from the day shift to prepare the mine for the next day's production. At about 7:00 p.m., a mechanic was working on the surface water pump when he noticed heavy black smoke coming from the # 1 PRODUCTION SHAFT. A short time later the electrical power failed. We have been unable to establish contact with anyone underground. Electrical power has been restored to the shafts and fan, but the fan has not been restarted.

I have called all of the government agencies for help. Guards have been posted at both shaft entrances to the mine and at the main fan. There is a fully equipped mine rescue team ready to be your team's backup, and another team will be sent in to replace you after two hours.

It is now 9:00 p.m. If your team is willing to help, we would like you to locate and rescue the three missing miners, explore and map all accessible areas of the mine, and seal or extinguish any fires. All materials needed to work this problem are located in the mine and are identified with placards.

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**MINE INFORMATION SHEET  
FOSDENK CLAY COMPANY, SEPTEMBER SONG MINE**

**Mining & Equipment:**

The 400-foot deep single-level shaft mine uses a conventional room and pillar method to extract a high-quality fire clay from the Freeport Clay seam. The broken ore is transported to the # 1 PRODUCTION SHAFT using battery-powered LHD's. The ore is then transported to the surface via the production skip. The average mining height is six feet, however, the height may vary depending upon the thickness of the bituminous coal header (seam of coal on the roof 12 - 18 inches thick). The face drill and roof bolting machines are electrically powered.

**Gas:**

The mine is classified as a Category IV mine, that is, any methane concentrations liberated are not explosive and are not capable of forming explosive mixtures with air, based on the history of the mine.

**Water:**

The mine has a history of water problems and has consistently produced about 100 gallons of water per minute from the production faces and fire clay bottoms.

**Pumps:**

The main water pump, located on the surface, is equipped with a suction line to each of the shaft bottoms. Each shaft is equipped with a ten-foot deep sump, and the main water pump can easily handle the volume of water produced. A portable sump pump and discharge line is used to remove water from the working faces to either of the shaft sumps. The main water pump is down at this time but a mechanic is working on it.

**Electricity:**

The underground electrical power is off. A 4160-volt power feeder cable supplies power to the main power center, located in ENTRY 3. The roof bolter and face drill are supplied with 440-480 volt power from the power center.

**Ventilation:**

The main fan is a blowing fan, located on the surface, and is non-reversible. The electrical power to the fan is off, locked out, and guarded, but can be restarted if needed. The air enters the mine through the # 2 SERVICE SHAFT, and exhausts out of the # 1 PRODUCTION SHAFT. Air is directed to the faces using permanent and temporary ventilation controls.

**Roof Support:**

The immediate roof is supported by 8-foot long roof bolts, installed on 4-foot centers. Wooden timbers are available for additional support in problem areas.

**Recovery:**

No recovery work has been performed.

**Mine Map:**

The mine map is up-to-date.

**Other Mines:**

There is one active coal mine and several other abandoned clay mines in the area. However, this mine does not connect to any of these other mines.

**Explosives:**

Explosives are used in the mining cycle, but only enough for a days use are stored underground.

**Communications:**

Two pager phones are available in the mine and normally have contact with the surface. The current phone locations are marked on the mine map. At this time, we do not know the status of the communication system.

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This afternoon, the foreman and two crew members worked over from the day shift to prepare the mine for the next day's production. At about 7:00 p.m., a mechanic was working on the surface water pump when he noticed heavy black smoke coming from the # 1 PRODUCTION SHAFT. A short time later the electrical power failed. We have been unable to establish contact with anyone underground. Electrical power has been restored to the shafts and fan, but the fan has not been restarted.

I have called all of the government agencies for help. Guards have been posted at both shaft entrances to the mine and at the main fan. There is a fully equipped mine rescue team ready to be your team's backup, and another team will be sent in to replace you after two hours.

It is now 9:00 p.m. If your team is willing to help, we would like you to locate and rescue the three missing miners, explore and map all accessible areas of the mine, and seal or extinguish any fires. All materials needed to work this problem are located in the mine and are identified with placards.

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**PROBLEM ORIENTATION  
STATEMENT OF “OFFICIAL IN CHARGE”**

1. Introduce yourself to the team as the mine manager and then introduce the #1, #2, #3, and lifeline judges to the team.
2. Read the following team briefing statement to the team:

You are located on the surface of the Fosdenk Clay Company’s September Song Mine. The mine is a single-level underground mine opened by two shafts 400 feet deep. The # 1 PRODUCTION SHAFT is the exhaust shaft and is used for hoisting ore from the mine, and as the emergency escape way. The # 2 SERVICE SHAFT is the intake shaft and is used to transport people and supplies. High-grade clay is mined by the room and pillar method. The entries are initially driven approximately six to seven feet high and ten to twelve feet wide. A bituminous coal header, twelve to eighteen inches thick, borders the roof, and is supported by eight foot roof bolts. The roof is fairly competent, but coal sluffage occasionally occurs and may be additionally supported by wooden posts.

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I have called all of the government agencies for help. Guards have been posted at both shaft entrances to the mine and at the main fan. There is a fully equipped mine rescue team ready to be your team’s backup, and another team will be sent in to replace you after two hours.

It is now 9:00 p.m. If your team is willing to help, we would like you to locate and rescue the three missing miners, explore and map all accessible areas of the mine, and seal or extinguish any fires. All materials needed to work this problem are located in the mine and are identified with placards.

3. Answer the team’s questions. Only provide information that is consistent with the mine information sheet.
4. Provide the team with the following instructions:  
I will give you two copies of the team briefing statement, the mine information sheet, and the mine map after you start the clock. Further, the fresh air base attendant may not communicate with anyone except the team or the mine manager.

Total Discounts \_\_\_\_\_

1998 Northern Invitational Mine Rescue Contest  
Benchman's Contest - Written Examination

Name \_\_\_\_\_

Company Name \_\_\_\_\_

Team Name \_\_\_\_\_

Team Draw Order \_\_\_\_\_

**Directions: Circle the correct answer for each multiple choice question.**

1. The regenerative canister contains a chemical that removes \_\_\_\_\_ from the exhaled air.  
A. hydrogen                      B. oxygen                      C. carbon dioxide
2. The rupture pressure of the oxygen cylinder pressure burst cap is \_\_\_\_\_ pounds per square inch.  
A. 4,400                      B. 3,980                      C. 4,450
3. When performing the whistle duration test, the whistle should sound for \_\_\_\_\_ to \_\_\_\_\_ seconds.  
A. 20 - 60                      B. 18 - 45                      C. 20 - 65
4. The saliva trap is located on the exhalation hose.  
A. True                      B. False
5. The oxygen cylinder must be hydrostatically tested every \_\_\_\_\_ years.  
A. 3                      B. 5                      C. 4
6. When the apparatus is approved for three (3) hours, the oxygen cylinder must be charged to a minimum of \_\_\_\_\_ p.s.i.  
A. 2,600                      B. 1,800                      C. 3,100

7. When performing the negative pressure leak test, the apparatus should be pumped to \_\_\_\_ millimeters water gauge and then bled down to -70 millimeters water gauge and monitored for 60 seconds.
- A. 80                      B. 90                      C. 100
8. The lowest temperature the apparatus is approved for use in, is \_\_\_\_\_ degrees Fahrenheit.
- A. + 14                      B. + 18                      C. + 12
9. When performing the breathing bag volume test, it should take at least \_\_\_\_\_ strokes before the bag deflates enough for you to hear the lung demand valve activate.
- A. 12                      B. 10                      C. 13
10. When the warning whistle on the apparatus sounds, you should have approximately \_\_\_\_\_ to \_\_\_\_\_ Minutes of oxygen remaining.
- A. 30 - 50                      B. 40 - 60                      C. 45 - 65
11. The pressure reducer reduces the high pressure from the oxygen cylinder to a working pressure of approximately 61 p.s.i.
- A. True                      B. False
12. The manual bypass can deliver up to \_\_\_\_\_ liters of oxygen per minute to the breathing bag.
- A. 30                      B. 40                      C. 50
13. The lowest allowable dosage of the apparatus is \_\_\_\_\_ liters of oxygen per minute.
- A. 1.4                      B. 1.6                      C. 1.7
14. The Draeger BG 174A is an open circuit apparatus.
- A. True                      B. False
15. When performing the pressure gauge equalization test, the chest gauge and bottle gauge should equalize within \_\_\_\_\_ percent of each other.
- A. 10                      B. 15                      C. 20

16. When the apparatus is approved for four (4) hours, the oxygen cylinder must be charged to a minimum of \_\_\_\_\_ p.s.i.
- A. 3,180                      B. 3,160                      C. 3,135
17. The length of wearing time for the apparatus can be determined by reading the approval label.
- A. True                      B. False
18. The pressure relief valve should be heard functioning between - 10 and - 40 millimeters water gauge.
- A. True                      B. False
19. The warning whistle on the four (4) hour apparatus should sound when the oxygen bottle pressure drops to approximately \_\_\_\_\_ p.s.i.
- A. 700                      B. 800                      C. 600
20. When the apparatus is approved for two (2) hours, the oxygen cylinder must be charged to a minimum of \_\_\_\_\_ Pounds per square inch.
- A. 2,600                      B. 1,800                      C. 3,100
21. The pressure “burst cap” on a 4-hour cylinder (3,135 p.s.i.) will rupture when the cylinder reaches a temperature of approximately \_\_\_\_\_ degrees Fahrenheit.
- A. 300                      B. 500                      C. 700
22. The shelf-life of the chemical used to fill the training canister is approximately \_\_\_\_\_ years from date of manufacture.
- A. 2                      B. 3                      C. 5
23. Federal law requires that an accurate record of each test performed on the apparatus must be maintained for a period of \_\_\_\_\_ .
- A. 6 months                      B. 1 year                      C. 5 years



24. During the testing of the apparatus with the Draeger Universal RZ 25 tester, the test will not be accurate if the oxygen cylinder is filled to less than \_\_\_\_\_ p.s.i.

A. 1,000

B. 1,400

C. 2,000

25. All rubber or neoprene sealing rings must be replaced in the apparatus every \_\_\_\_\_ years.

A. 1

B. 2

C. 3

Name \_\_\_\_\_

Team Name \_\_\_\_\_

Contest Position Number \_\_\_\_\_

Team Member Number \_\_\_\_\_

**1998 Northern Invitational Mine Rescue Contest**  
**September 18 - 19, 1998**  
**Batavia, New York**

**Directions: Circle the letter preceding the correct answer to each of the following questions.**

1. Your team is about to enter a mine containing "iron pyrite." You know a fire is burning. You should check for:
  - A. carbon dioxide
  - B. hydrogen sulfide
  - C. sulfur dioxide
  - D. oxides of nitrogen
  
2. Sometimes permanent bulkheads have a man door or drop door in them to allow miners to pass through.
  - A. True
  - B. False
  
3. Asphyxiation occurs when one gas replaces any other gas.
  - A. True
  - B. False
  
4. While fighting a fire with a hand-held fire extinguisher, you should:
  - A. Direct the stream of dry chemical to about six inches ahead of the flame edge.
  - B. Be sure to maintain control of the extinguisher.
  - C. Be on the alert for possible re-ignition of the fire.
  - D. All of the above.
  - E. None of the above.
  
5. Your team is at the fresh air base. Chemical analysis has shown an appreciable amount of oxides of nitrogen. You should suspect:
  - A. PVC or conveyor belt burning.
  - B. Penetration into an oil or gas well.
  - C. Detonation and burning of explosives.
  - D. None of the above.
  
6. Once the coordinator at the fresh air base receives the progress report:
  - A. It is recorded in a log book.
  - B. The fresh air base attendant makes a decision on whether to continue.
  - C. The information is then relayed on to the command center.
  - D. All of the above.

7. It is usually recommended that the power to the fire area be cut off only if the fire is a class "C" fire.
  - A. True
  - B. False
8. The safest procedure for getting survivors out of the refuge chamber or barricade is:
  - A. Build an airlock.
  - B. Use self-rescuers.
  - C. Advance fresh air.
  - D. Break into the barricade quickly.
9. Your team captain should constantly conduct visual inspections of the back and sides as you advance unless smoke makes this impossible.
  - A. True
  - B. False
10. After death, the putrefaction (decay) process begins sooner in muscular bodies than in obese bodies.
  - A. True
  - B. False
11. The fresh air base coordinator will check the condition of the backup team at the fresh air base.
  - A. True
  - B. False
12. In some mines the fire doors will close automatically when the \_\_\_\_\_ in the air reaches a certain level.
  - A. carbon dioxide
  - B. oxygen deficiency
  - C. temperature
  - D. carbon monoxide
13. Which of the following methods is not used to help you see better when exploring in smoke?
  - A. Remove your cap lamp and hold it at waist level.
  - B. Use the "flood spot" if your light has one.
  - C. Use a high intensity light that is used in some mines.
  - D. Let the lamp hang from the cord to light up the rail or side that you're moving along.
14. If nothing else is available, a smoke tube can always be used to determine air velocity.
  - A. True
  - b. False

15. Your team encounters a class "B" fire too large to control with small fire extinguishers. In the mine, there is a wheeled fire extinguisher painted with a blue circle. You should:
- A. Use the wheeled fire extinguisher
  - B. Seal the fire
  - C. Use water
  - D. Do nothing
16. "Simultaneous mapping" includes:
- A. The map man's map
  - B. The fresh air base coordinator's map
  - C. The command center's map
  - D. All of the above
  - E. Only A and B
17. The mine rescue team has the option to start ventilation into an unexplored area to remove gases, but should not stop ventilation into an unexplored area because of gas build-up.
- A. True
  - B. False
18. Chemical analysis has shown increased nitrogen levels. You should suspect:
- A. Explosives have been detonated
  - B. Inadequate ventilation
  - C. Rock-strata gas
  - D. Any of the above
19. A 30 pound fire extinguisher will normally last 18 to 25 seconds.
- A. True
  - B. False
20. Tiny particles of solid and liquid matter suspended in air is called:
- A. The damp
  - B. Smoke
  - C. Gases
  - D. All of the above
21. Low expansion foam can only be used when you're close enough to a fire to force the foam directly onto the fire.
- A. True
  - B. False
22. High expansion foam removes two legs of the fire triangle. They are:
- A. Fuel and oxygen
  - B. Oxygen and heat
  - C. Heat and fuel

- D. None of the above
23. Chest injuries take priority over back injuries with spinal injuries in the triage system.  
A. True  
B. False
24. Moderate shock takes priority over a fractured arm under the triage system.  
A. True  
B. False
25. A regular anemometer actually measures \_\_\_\_\_ of the air.  
A. velocity  
B. gas concentrations  
C. linear feet of travel  
D. area

**Written Test Answer Key**  
**1998 Northern Invitational Mine Rescue Contest**  
**September 18 - 19, 1998**  
**Batavia, New York**

<b>Q</b>	<b>A</b>	<b>Module</b>	<b>Page</b>
1.	C	2202	41
2.	A	2203	13
3.	B	2202	19
4.	D	2205	12
5.	C	2202	35
6.	C	2204	49
7.	B	2205	23
8.	C	2206	6
9.	A	2204	47
10.	B	2206	15
11.	A	2204	13
12.	D	2203	21
13.	B	2204	43
14.	B	2203	27
15.	B	2205	57
16.	D	2204	51
17.	B	2203	25
18.	D	2202	29
19.	A	2205	12
20.	B	2202	49
21.	A	2205	16
22.	B	2205	17
23.	A	2206	8
24.	A	2206	8
25.	C	2203	27