**2014 North Central Mine Rescue Contest**

**Wilmington, IL**

**Written Test – Technician Team Competition**

**Industrial Scientific Multi-Gas Detector, MX6**

***Directions: Select the letter preceding the BEST answer to each of the following questions. Choose only one answer per question.***

#### MSHA Publication 3027 - Module 2 Mine Gases

#### MSHA Publication 3027 - Module 3 Ventilation

#### Metal and Nonmetal National Mine Rescue Contest Rules 2014

**1.** **The technician team competition may include which of the following test components:**

A. Two self-contained breathing apparatus

B. Back board

C. First Aid Kit

D. All of the above

**2. Soluble gases may be released into mine air from groundwater.**

 A. True

 B. False

**3. During mine rescue and recovery work the command center directly approves all:**

A. Ventilation Tests

B. Ventilation Construction

C. Ventilation Alterations

D. B and C only

**4. The purpose of mine ventilation is to provide a velocity of air sufficient to remove harmful gases, dust, smoke and fumes.**

1. True
2. False

**MX6 Multi-Gas Detector**

**5. Which of the following properties are associated with Hydrogen Sulfide gas:**

A. The gas is one of the most poisonous known.

B. The gas is not soluble in water.

C. The gas is yellowish, with an odor of rotten eggs.

D. All of the above.

**6. Line Brattice must be permanently installed for short duration ventilation applications.**

A. True

B. False

**7.** **Check Curtains or Run-Through Curtains are designed to:**

A. Close manually after you have passed through them.

B. Deflect the intake air current into a working area.

C. Fasten at the top and one side only.

D. All of the above.

**8. Which of the following properties are associated with Acetylene gas:**

A. The gas is highly flammable.

B. Found after methane explosions in air having a low oxygen content.

C. The gas is slightly toxic.

D. B and C only.

**9.** **If a mine ventilation system is badly damaged or is out completely, the distinction between intake and exhaust air on the mine map may not be valid.**

A. True

B. False

**10.** **Auxiliary fan tubing used to control and direct airflow to or from a mining area will be:**

A. Rigid tubing for forcing systems

B. Collapsible tubing for exhaust systems

C. Usually suspended from timbers or eye bolts

D. All of the above

**MX6 Multi-Gas Detector**

**MX6 iBrid Multi-Gas Instrument**

**Instruction Manual**

**Revision 6, March 2013**

**11.** **The IR (infrared) methane sensor is not to be used for methane concentrations below:**

A. 2.5% in air.

B. 1.0% in air.

C. 5.0% in air.

D. 0.5% in air.

**12.** **If a LCD sensor name is blinking, and black in color, it indicates a failed sensor.**

A. True

B. False

**13.** **The confidence alarm can be activated only as an audible beep.**

A. True

B. False

**14**. **Fully charging the MX6 lithium-ion battery pack will take approximately:**

A. 3 hours

B. 8 hours

C. 2 hours

D. 5 hours

**15.** **Gas concentrations above a sensor’s detection limit are displayed on the LCD as:**

A. Blinking red STEL.

B. Solid red HIGH.

C. Solid green OR.

D. Blinking red OR.

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**16.** **Leather carrying cases can produce inaccurate readings with diffusion (non-aspirated) detection instruments if configured to measure which of the following gases?**

A. Oxygen

B. Nitrogen Dioxide

C. Carbon Dioxide

D. Hydrogen Sulfide

**17.** **The oxygen sensor warning alarm provides two, unique, audible alarms - a low-level warning for low-oxygen environments and a high-level warning for enriched-oxygen environments.**

A. True

B. False

**18.** **User configurable alarms include which of the following modes:**

A. Vibrate

B. Audible

C. Visual

D. All of the above

**19.** **Oxygen deficient atmospheres may cause combustible gas readings to be:**

A. Higher than actual readings

B. Unaffected

C. Lower than actual readings

D. Latch over range (+OR)

**20.** **If battery life remaining is less than one hour the battery icon flashes and an audible alarm is initiated.**

A. True

B. False

**MX6 Multi-Gas Detector**

**21.** **Sensor Menu – Zero All option will perform which of the following:**

A. CO2 sensor is zeroed first – if present.

B. O2 sensor is calibrated – if present.

C. All toxic gas sensors are zeroed.

D. B and C are correct.

**22.** **The MX6 alkaline battery pack should adhere to which of the following guidelines:**

A. Use three alkaline cells.

B. Mixing batteries from different manufacturers is acceptable.

C. Battery packs can be replaced in a gassy area.

D. All of the above.

**23.** **The MX6 should not be used in oxygen-enriched atmospheres.**

A. True

B. False

**24.** **Industrial Scientific recommends that a functional (bump) test be performed on every instrument:**

A. Once every month.

B. Before each days use.

C. Before use in oxygen-deficient atmospheres.

D. At least weekly.

**25.** **The recommended calibration gas flow rate is:**

A. 5.0 LPM

B. 0.75 LPM

C. 1.0 LPM

D. 0.5 LPM

**MX6 Multi-Gas Detector**

**26.** **When sampling with a motorized pump and tubing - to let the sensors adequately react to any gases present allow:**

A. One minute delay.

B. Two minute delay + two minutes per foot of tubing.

C. One minute delay + one minute per foot of tubing.

D. Two minute delay + two seconds per foot of tubing.

**27.** **Sudden changes in atmospheric pressure may cause temporary fluctuations in the combustible gas reading.**

A. True

B. False

**28.** **The MX6’s four steps of operation before each days use include which of the following:**

A. Zero the instrument in fresh air.

B. Clean the water barrier of contaminants.

C. Calibrate the sensors.

D. Both A and C are correct.

**29.** **Instrument alarms are used during calibration to confirm alarm performance.**

A. True

B. False

**30.** **The MX6 LCD screen may present any of the following “indicators” except:**

A. Text box windows.

B. Escape button.

C. Radio buttons.

D. Single function buttons.

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| **ANSWER SOURCE KEY** |
| MSHA Publication 3027 - Module 2 Mine GasesMSHA Publication 3027 - Module 3 VentilationMetal and Nonmetal National Mine Rescue Contest Rules 2014 |
| **Question** | **Answer** | **Source** |
| **1** | **A** | **2014 Metal and Nonmetal Mine Rescue Contest Rules, Technician Team Competition, Page 61, General Rule 1***Comments*: Back board removed 2014, First aid kit removed 2014, Gas detector and Communications system must also be included. |
| **2** | **A** | **Mine Gases, Module 2, Page(s) 2-7, Solubility***Comments*: True |
| **3** | **D** | **Mine Ventilation, Module 3, Page(s) 3-21 – Building Ventilation Controls****Mine Ventilation, Module 3, Page 3-3 – Introduction***Comments*: Ventilation testing is not under command center control as it will not alter mine conditions |
| **4** | **B** | **Mine Ventilation, Module 3, Page(s) 3-4***Comments*: Volume not velocity, Also must provide adequate oxygen |
| **5** | **A** | **Mine Gases, Module 2, Page(s) 2-19 and 20***Comments*: It is water soluble, It is colorless |
| **6** | **B** | **Mine Ventilation, Module 3, Page(s) 3-24 – Line Brattice***Comments*: Can be held in place by team members |
| **7** | **B** | **Mine Ventilation, Module 3, Page(s) 3-9 – Check Curtains***Comments*: Close automatically, Fasten at the top only |
| **8** | **D** | **Mine Gases, Module 2, Page(s) 2-24***Comments*: It is combustible, but it will not support combustion. |
| **9** | **A** | **Mine Ventilation, Module 3, Page(s) 3-6 – Note to Trainer***Comments*: Normal production conditions may no longer be valid |
| **10** | **C** | **Mine Ventilation, Module 3, Page(s) 3-10 – Auxiliary Fans and Tubing***Comments*: Flexible for forcing, Rigid for exhaust |

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| **ANSWER SOURCE KEY** |
| **MX6 iBrid Multi-Gas Instrument****Instruction Manual****Revision 6, March 2013** |
| **Question** | **Answer** | **Source** |
| **11** | **C** | **Rev 6, pg. 6, Warnings and Cautionary Statements***Comments*: Specified in Manual. |
| **12** | **B** | **Rev 6, pg. 15, Normal Operation Mode – NOTE:***Comments*: Black color indicates normal operation, Blinking indicates alarm condition. |
| **13** | **B** | **Rev 6, pg. 24, Configuration Menus - Alarms***Comments*: The alarm can be audible, visual, vibration – and any combination of the three. |
| **14** | **B** | **Rev 6, pg. 11, Charging the Batteries***Comments*: Specified in Manual. |
| **15** | **D** | **Rev 6, pg. 15, Normal Operation Mode – NOTE:***Comments*: STEL is an alternative alarm indicator. |
| **16** | **B** | **Rev 6, pg. 5, Warnings and Cautionary Statements***Comments*: The other three gases are specifically exempted. |
| **17** | **B** | **Rev 6, pg. 8, Key Features – Audio Indicator***Comments*: Only a single audible alarm for either event. |
| **18** | **D** | **Rev 6, pg. 24, Configuration Menus***Comments*: Latch and Confidence Beep are included in the alarm menu – but are not alarms. |
| **19** | **C** | **Rev 6, pg. 4, Warnings and Cautionary Statements***Comments*: The sensor needs O2 to respond, standard wheatstone bridge response. |
| **20** | **A** | **Rev 6, pg. 12, Charging the Battery – NOTE:***Comments*: Visible and audible warnings. |
| **21** | **D** | **Rev 6, pg. 19, Zero All Option***Comments*: CO2 is calibrated last with Zero Air. |
| **22** | **A** | **Rev 6, pg. 6, Warnings and Cautionary Statements – Conditions of Use***Comments*: Mixing manufacturers is not recommended, Individual alkaline batteries can be replaced in a gassy area – not packs. |
| **23** | **A** | **Rev 6, pg. 4, Warnings and Cautionary Statements***Comments*: Specified in Manual. |

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| **ANSWER SOURCE KEY** |
| **iTX Multi-Gas Instrument****Instruction Manual****Revision 9, September 2011** |
| **Question** | **Answer** | **Source** |
| **24** | **B** | **Rev 6, pg. 18, Calibration Policy***Comments*: Confirms correct operation between calibration events. |
| **25** | **D** | **Rev 6, pg. 20, Calibrate Option***Comments*: Minimum acceptable flow rate. |
| **26** | **D** | **Rev 6, pg. 5, Warning and Cautionary Statements***Comments*: Sample travel delay time. |
| **27** | **B** | **Rev 6, pg. 4, Warning and Cautionary Statements***Comments*: May impact Oxygen reading. |
| **28** | **A** | **IBRID MX6 Four Steps of Operation Guide***Comments*: Water Barrier is not included, Bump Test is required, Clear peak readings. |
| **29** | **B** | **Rev 6, pg. 19, Calibration Options***Comments*: Alarms are deactivated during calibration to save battery life. |
| **30** | **B** | **Rev 6, pg. 13, Menu Operation Basics***Comments:* There is no “Escape” button – the “Cancel” button serves this purpose. |