Carbon Dioxide Safety Program Final Exam – Open Book Test

Name (please print): _____

Date:_____

Chapter 1

1. CO_2 can only accumulate in areas of confined or restricted spaces? True or False

2. When developing a carbon dioxide Facility Review Process it should contain the following (please circle all that apply):
    a. CO_2 evaluation anywhere where the air is windy
    b. You should use a hand held CO_2 monitor
    c. If you can only take a single survey, it should be under the most representative normal process conditions
    d. You should conduct multiple surveys
    e. Do repeat walk-throughs during various weather conditions

3. To prevent unsafe levels of CO_2 within the work space please consider which of the following:
    a. Place remote sensors in the middle of a building to best represent readings of CO_2 levels in the general work area.
    b. If remote sensors used for CO_2 monitoring are rugged enough, preventive maintenance is not necessary
    c. Ensure mechanical ventilation is provided in all areas where CO_2 can collect
    d. B and C
    e. A and B

4. When providing specific comprehensive worker CO_2 training, you should consider which of the following (please circle all that apply):
    a. The audience should be all workers outside of office areas
    b. Workers need education on all portable CO_2 monitors in use in the facility
    c. Workers need to be especially aware of low wind CO_2 exposure sites
    d. The chemical hazard communication program should include labeling, adverse health effects, worker training, exposure monitoring and (M)SDS for CO_2.

5. CO_2 is heavier than air? True or False

6. Locations where process-generated CO_2 can collect include which of the following:
    a. Buildings where fermentation tanks are housed
    b. Confined areas including diked areas around any tank
    c. In open drains from process areas
    d. Where CO_2 is collected and discharged

Chapter 2

1. Since CO_2 is believed to be stable and relatively inert, a number of metal dusts can be suspended in CO_2 safely. They include but are not limited to aluminum, titanium and chromium. True or False

2. CO_2 in the atmosphere is at a concentration of :
    a. 20.9 % (209,000 ppm)
    b. 0.8% (8,000 ppm)
    c. 0.04% (400 ppm)
    d. 7% (70,000 ppm)
3. Which of the following is not true:
    a. Since CO_2 is part of the atmosphere it is roughly the same density
    b. The solid form of CO_2 is called "dry ice"
    c. CO_2 is non-flammable
    d. CO_2 is a common and abundant gas on Earth

4. When CO_2 is dissolved in water it forms a weak base in solution (mildly increases the pH). True and False

Chapter 3

1. The carbon cycle that is most important for the movement of carbon between the environment and living things is called the slow carbon cycle? True or False

2. In the present of sunlight all green plants are able to manufacture glucose and oxygen from CO_2 and water. True or False

3. Respiration includes all of the following except:
    a. Is considered a "combustion process"
    b. Is a process all aerobic organisms with or without chlorophyll do
    c. Manufacture simple glucose as a byproduct of this process
    d. Green plants perform this process at night

4. Waste water treatment, sewers, landfills, manure collection, and agriculture process residues have what in common? (circle all that apply)
    a. Photosynthesis
    b. Aerobic biological processes
    c. Produce large quantities of CO_2

5. Ethanol production is based upon the fermentation of carbon dioxide by yeast? True or False

6. Which process below is not involved in ethanol production:
    a. Dry milling
    b. Cellulosic Biomass
    c. Wet "steeped" grain in water
    d. Geothermal combustion

Chapter 4

1. All of the following processes use carbon dioxide during manufacturing or part of the finished product. True or False
    a. Decaffeinating coffee
    b. Refrigeration of dairy products during transport
    c. "carbonated" beverage (including beer) production
    d. Propellant in paint ball markers
    e. Some extinguishers for electrical fires

2. CO_2 is a common water treatment primarily because:
    a. It is pH neutral and doesn't affect water quality
    b. It is weakly acidic nature
    c. It readily dissipates when in solution
    d. It neutralizes weakly acidic water

3. Carbon dioxide is soluble in water and forms a carbonic base. True or False

Chapter 5

1. In the presence of normal oxygen levels death can occur within five minutes at which concentration of CO_2 in air?
    a. 7%
    b. 20.9%
    c. 0.04%
    d. 0.8%
2. Exposure to the following concentration of carbon dioxide can cause dizziness, drowsiness, severe muscle twitching and unconsciousness. (choose the best answer)
    a. 0.5%
    b. 30%
    c. 1%
    d. 10%

3. All the following are symptoms of overexposure to CO_2 except:
    a. Headaches
    b. Nausea
    c. Increased heart rate
    d. Cold, clammy skin
    e. Cardiac arrhythmia
    f. Hearing loss
    g. Ringing in the ears
    h. Lack of concentration

4. Acidosis is what?
    a. CO_2 levels in the blood become excessive
    b. Greater than 3% CO_2 is exhaled through the lungs
    c. CO_2 generates cell metabolites in the blood
    d. Caused by extreme fatigue

5. Breathing is stimulated by excessive CO_2, not lack of oxygen. True or False

6. Adverse cognitive effects from CO_2 have been observed as low as what concentration in air: (choose the best answer)
    a. 5,000 ppm over 8 hours
    b. 1,000 ppm over 2.5 hours
    c. 2,500 ppm over 2.5 hours
    d. 500 ppm over 60 minutes

Chapter 6

1. Nitrogen, argon, and carbon dioxide are all asphyxiant gases. True or False

2. The Apollo 13 incident forced the crew to make from spare parts several _____ to successfully return to earth, even though they had enough available oxygen for the round trip:
    a. Generators
    b. CO_2 scrubbers
    c. Heat exchangers
    d. Water delivery devices

3. In the ethanol production fatality case which of the following was not a factor in their CO_2 overexposure:
    a. Draining of the fermenter as far as normal discharge piping would allow
    b. Workers entering the diked area
    c. Workers going back inside the interstice building immediately after opening the outside manway
    d. Opening the D manway within the building

4. "Black damp" referred to what:
    a. Coal miner's name for when they were working in a hazardous CO_2 atmosphere
    b. Candle manufacturing industry when the flame would flicker out due to excessive CO_2 buildup in their factories
    c. Pet shop owners would observe this effect when canaries would "keel over" in their cages due to excessive CO_2 within their shops due to coal heaters
    d. Warning for CO_2 overexposure in the timber industry

Chapter 7

1. The Federal agency responsible for assuring the safety and health of United States workers is:
    a. NIOSH
    b. ACGIH
    c. OSHA
    d. WHO

2. Countries that have more restrictive CO_2 protection limits than the US are: (please circle all that apply)
    a. Germany
    b. UK
    c. France
    d. Sweden

3. U.S. agencies and professional organizations (OSHA, NIOSH, ACGIH) that have 8 or 10-hour time-weighted-average (TWA) exposure limits set those CO_2 recommended or permissible workplace exposure limits nearly 50 years ago. True or False

Chapter 8

1. General principles that need to be addressed for safely handling CO_2 in railcars and tank cars include which of the following: (please circle all that apply)
    a. Understanding CO_2 physical and chemical properties
    b. Routinely inspecting and testing of hoses, piping systems, relief values and other service equipment
    c. Fully complying with CO_2 Department of Transportation regulations and standards governing its handling
    d. Implementing requirements that assure workers are held accountable for handling of CO_2 regardless of the work environment.
    e. Maintaining CO_2 testing and inspection records

Chapter 9

1. Since CO_2 dissolves in water, systems that handling carbon dioxide must be fabricated from acid-resistant materials such as certain stainless steel, Hastelloy or Monel metal. True or False

2. To meet "CGA G-6.1 Standard for Low Pressure CO_2 Systems at Consumer Sites" which of the following metal fittings are recommended. (please circle all that my apply)
    a. Schedule 80 threaded pipe with forged steel fittings
    b. Seamless Schedule 40 steel pipe with welded joints
    c. Stainless steel with copper or brass pipes
    d. Steel with copper soldered fittings

3. When designing a ventilation system for a confined space that has excessive CO_2, you should design it to ventilate the space starting from:
    a. The lowest level of the equipment's space
    b. The highest point, since CO_2 generally rises to the top of the equipment space
    c. The farthest point from the source of the CO_2 emissions

4. For the ethanol manufacturing industries, it is not necessary to monitor the atmosphere for CO_2 when oxygen levels are routinely or continuously monitored. True or False

5. When working around or with gaseous CO_2 at or above 15 psia, the following PPE is recommended: (please circle all that apply)
    a. Hard hat
    b. Googles
    c. Steel-toed shoes
    d. Insulated mid-forearm gauntlet gloves
    e. Chemically resistant nitrile gloves
    f. Shirts with full length sleeves
    g. Resistant apron or other body protection
    h. Direct reading electronic CO_2 monitor
    i. Full face shield over the goggles

Chapter 10

1. Special consideration areas where CO_2 concentrations need to be evaluated for worker protection include: (circle all that apply)
    a. Confined spaces
    b. Roofs with emissions stack(s)
    c. Low-lying areas including culverts and diked areas around any tanks
    d. Locations with limited ventilation
    e. Locations where CO_2 is given off from processes inside buildings
    f. Areas where CO_2 is scrubbed
    g. Areas where CO_2 is measured at high levels

2. Pulling air by negative pressure to a safe place away from any intake location is called?
    a. Exhaust ventilation
    b. Supply ventilation
    c. Dilution ventilation
    d. Ventilation with make-up air

3. Supply air from an uncontaminated outside source is useful when air movement is provided for the comfort of workers inside the plant. True or False

4. Which of the following is a major disadvantage of mechanical ventilation in a confined space?
    a. The ductwork often takes up too much space for worker ease of entry
    b. The silent nature of the air movement makes it difficult to determine if it is working
    c. Air movement can be short-circuited
    d. It removes static from production surfaces making it difficult to ground or bond
    e. A and C

5. When there is little air movement carbon dioxide tends to collect in low lying areas. True or False

Chapter 11

1. Electronic monitors are the fastest, the most reliable and the most accurate of the available CO_2 sampling techniques. True or False

2. The most widely used CO_2 detector used for real time measurements is:
    a. NDIR
    b. Detector tubes
    c. Ultra-violet spectroscopy
    d. Portable mass spectroscopy
    e. Mono-filament hot-wire detectors

3. The most common accuracy of colorimetric direct reading tubes are:
    a. $\pm$ 10%
    b. $\pm$ 25%
    c. $\pm$ 5%
    d. $\pm$ 1%
    e. $\pm$ 50%
4. Detector tubes work on a principle that each airborne substance can react chemically with a specific material and cause a color change that can be visually measured in the tube. True and False

5. Portable monitors used in the Ethanol manufacturing industries for confined space entry and other air monitoring need to include the following sensors: (circle all that apply)
    a. Lower explosive limit (LEL)
    b. Carbon monoxide (CO)
    c. Ammonia (NH_3)
    d. Carbon dioxide (CO_2)
    e. Hydrogen sulfide (H_2S)
    f. Oxygen (O_2)
    g. Nitrogen (N_2)