

Name: _____ Student ID _____

Prince of Songkla University
Faculty of Engineering

Exam: Mid-Term, Semester II

Date: December 24, 2003

Subject: 230-476 – Safety

(Safety in Chemical Engineering Operations)

Academic Year: 2003 – 2004

Time: 1:30 – 4:30 PM

Room: A201

Instructions: There are a total of 3 parts 9 pages. Place your name and the student ID number on every page. Students are allowed to use only a pen or pencil. No exams are allowed to leave the room.

Points Distribution (For Grader Only)		
Part	Points Value	Score
I	30	
II	63	
III	64	
Total	157	

**Exam prepared by
Ram Yamsaengsung
December 17, 2003**

**PLEASE CHECK TO MAKE SURE THAT
YOU HAVE ALL 9 PAGES OF THE EXAM BEFORE BEGINNING
(not including the cover sheet).
GOOD LUCK!**

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Closed Book Exam (No books or notes allowed)

I. Fill in the blanks (30 points)

1. The maximum amount of flammable materials that should be stored in the lab is _____.
2. Cobalt (27) and Radium (28) are two examples of _____.
3. _____ are highly toxic by ingestion and are rapidly absorbed by the skin producing intensive burns.
4. The _____ ensures the safe operation of the lab and the adequate training of technicians, etc. in health and safety matters.
5. A signature on behalf of the _____ must be present on the safety policy.
6. LPG is an abbreviation for _____ and must be stored in properly designed vessels, in which at least _____ unfilled space must be allowed to prevent the development of dangerous pressure.
7. To produce a fire, it is necessary to have _____, _____, and _____. This is also known as _____.
8. The _____ appoints the laboratory safety officer and is usually the head of the department.
9. The _____ acts as the secretary of the laboratory safety committee.
10. The _____ ensures that equipment used in work under their direction is of safe design and construction.
11. The storage of bulk amount of toxic and chemical liquids is preferably stored in _____.
12. In a well design facility, the equipment should only take up about _____ % of the entire floor space.
13. A _____ (large or small) quantity of chemical should be stored in the laboratories.
14. An inflammation of the skin that causes an allergic reaction is called _____.
15. The sudden release of vacuum is called _____.
16. Tanks containing _____ have a red band and tanks that contain _____ have yellow band.
17. Metal containers should have about _____ % extra space to allow for liquid expansion.
18. Generally, cylinders containing _____ are either completely red or have a red band.

19. The preferred method of stacking drums in the open air is to stack them _____.
20. Steel support should be able to withstand fire for at least _____ hour(s).
21. The maximum bulk storage for toxic or flammable liquids is _____.
22. The _____ is responsible for arranging inspection of the storage materials. The inspection should be conducted every _____.
23. Phenol, Cresol, and Xylenol are very dangerous _____.
24. HAZOP is an abbreviation for _____ which is a safety check lists that should be carried out before authorizing work liable to have serious mechanical, flammable, or toxic hazard.

II. Shorts Answers (63 points)

1. What is a non-flammable gas and can it be dangerous? Name two examples of non-flammable gas that are generally stored in gas cylinders. **(4 points)**

2. What is fire point? **(2 points)**

3. What is an oxidizing agent? Name two examples. **(4 points)**

4. Name 4 basic ways to prevent a fire in home and office. **(4 points)**

5. Name 4 ways of extinguishing a fire. **(4 points)**

6. Which type of fire is the following: (Type A, B, C, or D) **(4 points)**

___ Metallic fire such as magnesium

___ Fire involving paper, wood, cloths

___ Electrical Fire

___ Gas or oil fire

7. Name 4 things that must be included in a general safety policy. **(4 points)**

8. What are the 2 types of human indiscipline mentioned that could cause hazards to others in the lab? **(2 points)**

9. Name 3 cases in which a lab investigator must wear eye and face protection. **(3 points)**

10. Name 8 hazards that are generally met in a typical Chemical Engineering Lab and give **one way** to prevent **each** hazard from occurring. **(16 points)**

11. Name 4 common ignition sources. **(6 points)**

12. Describe the low, medium, and high hazard zones in a typical R&D facility. Include specific examples in each of the zones. **(6 points)**

13. How should cylinders of compressed gases be stored? **(4 points)**

3. What does this symbol represent? What does it generally transport? How is this liquid stored at customers location? **(3 points)**



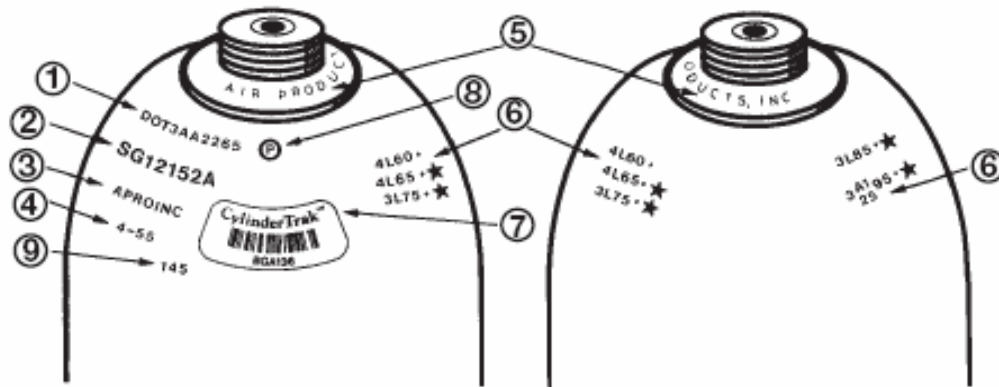
4. What does this symbol represent? What does it generally transport? How is this liquid stored at customers location? **(3 points)**



5. What is this a symbol of? What type of liquid does it generally store? Give 2 examples of chemicals that are stored in this container? **(4 points)**



6. Cylinder Identification (8 points)



Use the following information to answer the following questions.

1. DOT3AA2800
2. SG12152A
3. GASINC (Registered Symbol of Gas Inc.)
4. 6-75
5. Faculty of Engineering
6. 4L85 +★
7. Cylinder Tank Bar Code Label – BGA136
8. Cylinder Manufacturer's Inspection marking
9. TW 125

- 6.1 When was this tank manufactured?
- 6.2 Who is the current owner of this tank?
- 6.3 What is the tare weight of this tank?
- 6.4 What is the working pressure of this tank?
- 6.5 Who is the original owner of this tank?
- 6.6 What do the letters SG stand for?
- 6.7 When was this tank retested? (month and year)
- 6.8 Does this cylinder meet the requirement for 10-year retest?

7. **Natural Gas Line Failure: Agrium Fort Saskatchewan Nitrogen Operations -**
Pg.287 of *Process Safety Progress*
by Mark McConnell, Donald H. Timbres

While restarting an ammonia plant after a shutdown, the pipe line supplying natural gas to the sulfur removal section preheat coil in the primary reformer convection section ruptured. High-pressure natural gas from the rupture ignited causing significant fire damage. The gas line rupture was determined to have been caused by corrosion.

Examine the cause of the gas line failure and the corrective actions that should be taken to prevent a reoccurrence. **(8 points)**

8. **It's a bird, it's a plane, it's A Pump!**
Taken from *CCPS Process Safety Beacon*, October 2002.

The Incident

A 75 HP centrifugal pump was operated with both suction and discharge valves closed for about 45 minutes. It was believed to be completely full of liquid. A mechanical energy from the motor was transferred to heat, the liquid in the pump slowly increased in temperature and pressure until finally – the pump failed catastrophically. One fragment weighing 5 pounds was found over 400 feet away. Luckily, no one was in the area so there were no injuries.

Examine the cause of this explosion and what you could have done to prevent this accident. **(8 points)**

9. Identify the following symbols. (6 points)

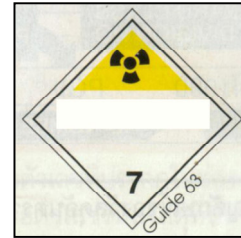
- (a)
- (b)
- (c)
- (d)
- (e)
- (f)



(a)



(b)



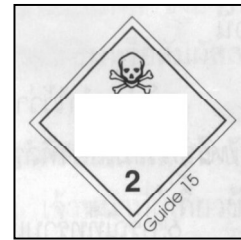
(c)



(d)



(e)



(f)

10. Name the 3 types of metals used to make gas cylinder. Which bulk tank is heavier, H₂S or SO₂? (4 points)