

Name: _____ Student ID _____

**Prince of Songkla University
Faculty of Engineering**

Final Exam, Semester II

Date: February 25, 2006

Subject: 230-434 – Safety

(Safety in Chemical Engineering Operations)

Academic Year: 2005 – 2006

Time: 9:00 – 12:00 PM

Room: R300

ทฤษฎีในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทฤษฎี และพักการเรียน 1 ภาคการศึกษา

Instructions: There are a total of 5 parts 10 pages not including the cover sheet. Place your name and the student ID number on every page. Students are allowed to use only a pen or pencil. After you finish the Closed Book Section, I will give you the Open Book Section. No exams are allowed to leave the room.

Points Distribution (For Grader Only)		
Part	Points Value	Score
I	30	
II	45	
III	35	
IV	60	
V	10	
Total	180	

**Exam prepared by
Ram Yamsaengsung
February 20, 2005**

**PLEASE CHECK TO MAKE SURE THAT
YOU HAVE ALL 11 PAGES OF THE EXAM BEFORE BEGINNING
(not including the cover sheet).
GOOD LUCK!**

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CLOSED BOOK SECTION (No books or notes allowed)

I. Fill in the blanks (30 points)

1. _____ should be worn when working with toxic and _____ chemicals.
2. After spillages, areas should be cleaned and _____ for at least _____ minutes.
3. 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.
4. Metal containers should have about _____ % extra space to allow for liquid expansion.
5. The storage of bulk amount of toxic and chemical liquids is preferably stored in _____.
6. The preferred method of stacking drums in the open air is to stack them _____.
7. Experiments can be classified as _____ and _____.
8. An _____ is used to prepare workers for emergencies such as the release of toxic gas.
9. The _____ will relieve the lab superintendent of the responsibility of main control and direct the shutting down and evacuation of the laboratory.
10. _____ should leave the building immediately upon hearing the fire alarm.
11. If there are some workers trapped inside the building, the 3 main tasks of emergency services team are _____, _____, and _____.
12. The _____ should be designated in a safe place in the open air where workers evacuating can meet.
13. Fire fighters, rescuers, first-aid providers are all _____ and will work under the direction of the _____ and later the _____.
14. The first-aid box should be provided in laboratories and should be located near the _____ with a list of trained personnel alongside.

15. The _____ have the responsibility of assisting the orderly evacuation of the building.
16. Upon discovering a major vapor or liquid escape of a hazardous material, persons should _____ and leave immediately.
17. A communicating door must be able to provide fire resistance for at least _____.
18. For high pressure equipment, the safety devices that must be installed include _____, _____, and _____.
19. 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 (45 points)

1. For each rig, name 5 items that the operating instructions must cover. **(5 points)**

2. Name 5 purposes of experimentation on the pilot-scale. **(5 points)**

3. Name 3 outside resources are generally contacted in cases of laboratory emergencies. **(3 points)**

4. When an emergency alarm goes-off (toxic gas release), what should personnel/workers do? In case of toxic releases, if the building is located upwind, what should you do? **(2 points)**

5. List 4 Guide Words and 4 Parameters that are used in HAZOP. **(8 points)**

6. Name 3 specific aims of first-aid. **(3 points)**

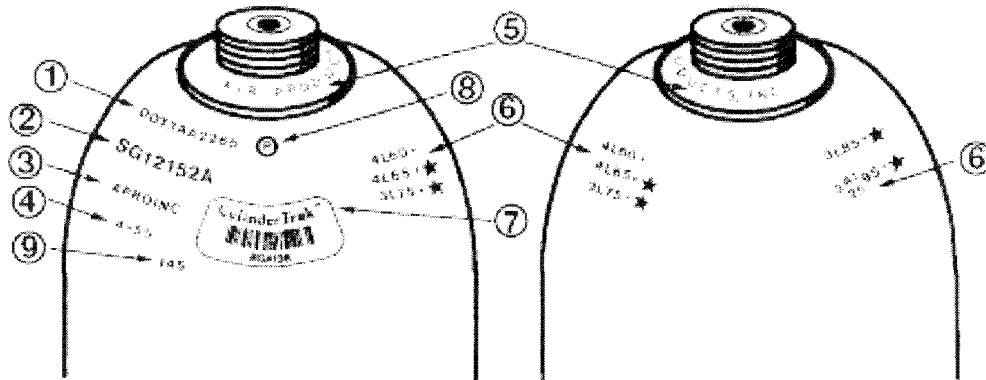
7. When working with machineries or moving parts, how must the machines be chosen? **(2 points)**

8. 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? **(3 points)**

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

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

11. Cylinder Identification (8 points)



Use the following information to answer the following questions.

1. DOT3AA3000
2. SG12152A
3. GASINC (Registered Symbol of Gas Inc.)
4. 8-50
5. Faculty of Engineering
6. 9L00 +★
7. Cylinder Tank Bar Code Label – BGA136
8. Cylinder Manufacturer's Inspection marking
9. TW 100

- 11.1 When was this tank manufactured?
- 11.2 Who is the current owner of this tank?
- 11.3 What is the tare weight of this tank?
- 11.4 What is the working pressure of this tank?
- 11.5 Who is the original owner of this tank?
- 11.6 What do the letters SG stand for?
- 11.7 When was this tank retested? (month and year)
- 11.8 Does this cylinder meet the requirement for 10-year retest?

III. Process Safety Beacon and Case Studies (35 points)

1. Write the meaning of each of these acronyms. **(8 points)**

- 1. NEMA _____
- 2. EFR _____
- 3. AIT _____
- 4. MCAS _____
- 5. BLEVE _____
- 6. MSDS _____
- 7. DOE _____
- 8. MOC _____

2. What are the two risk assessment criteria that are generally used? **(2 points)**

3. Draw a diagram of a typical storage tank and the safety devices that must be installed. **(10 points)**

4. What is the title of your semester case study project? Name 2 other semester projects that were presented by your classmates. **(3 points)**

5. Draw a schematic diagram of a control valve and the necessary components involved. **(4 points)**

6. Match the following information with the article that it was from? **(8 points)**

- (a) Flammable Gas in Enclosed Space = Boom!**
- (b) Overflow + Ignition Source = Tank Farm Fire**
- (c) Available when needed???**
- (d) Unapproved Procedure Change = Fire!**

- _____ 1. The level indication and the safety alarm system failed.
- _____ 2. A pickup truck exploded when the driver open the car door.
- _____ 3. A stripper caught fire after it was turned on.
- _____ 4. Hidden hazards should be identified.
- _____ 5. An acetylene mixture was the cause of the explosion.
- _____ 6. Oxygen was introduced into the vessel before the temperature had dropped below the autoignition point of some of the residual materials.
- _____ 7. Tree branches and chains prevent a valve from being operable.
- _____ 8. A hot car engine from an operator's truck caused an explosion.

3. From the HAZOP study of the Olefin Dimerization Unit: Line Section from Intermediate Storage to buffer/settling tank, answer the following questions. **(4 points)**
 - 3.1 What is a possible cause(s) of Less Temperature and the consequence(s) that followed? (2 points)

 - 3.2 What are the changes in Temperature and Pressure of the product leaving the heat exchanger? **(2 points)**

4. In Figure 2.2 of the HAZOP handout, what do PG, LIC, PIC stand for? What are the reaction conditions for the olefin dimerisation process? **(4 points)**

5. If there is a possibility of No Flow due Line fracture, what actions are required to prevent this? **(2 points)**

6. What are the functions of flame arresters? What are the main process locations in which they are usually installed? What are the typical flame and detonation speed? **(5 points)**

7. Which categories of seafood have the HIGH risks of infection upon consumption (when eaten)? Which categories DO NOT have potentials for growth of pathogens? Which group would “Pla Rah” be considered in? **(5 points)**

8. What does a control loop consist of? What is range of valve stroke that should be used when operating a control valve? What material can be used to coat the inside of the valve to slow down corrosion? **(5 points)**

9. In the Case Study presented in the MCAS article, for scenarios involving fires/explosions and toxic release, what factors must be considered for each? Which scenario of Ammonia release is the most dangerous? Which has the highest probability of occurring? **(5 points)**

10. From the Plant Safety Management Case Study, name 5 means of prevention of the release of toxic gas from the Storage Tank T-101. **(5 points)**

11. In the Simplifying Reliability Analysis of Chemical Processes Case Study, name 5 factors that influence human errors? **(5 points)**

12. What are the common types of enclosure used in outdoor applications and indoor applications? What type of materials are recommended for Acids and Alkalies resistance? **(3 points)**

13. What are the 3 fluid properties that must be considered in thermal fluid systems? If a system circulates 800 gal of fluid with a thermal expansion of 0.08 gal/gal of fluid per 100°F temperature rise and operates at 420°F, determine the size of the expansion tank for this system. Assume that room temperature is 70°F. **(5 points)**

14. What are the two types of floating roof tanks and when should they be used? What material (structure) is used for support of large tanks with diameter of more than 15 feet? **(5 points)**

V. Discussion (10 points)

1. What are the major benefits of the procedure or advices presented in your Case Study? How can the topic of your case study be implemented in the industries or universities of Thailand? **(10 points)**

Congratulations and Have a Good Summer!!!