Name: _____ Student ID _____

# Prince of Songkla University
# Faculty of Engineering

**Final Exam, Semester II** **Academic Year: 2006 – 2007**
**Date: February 19, 2007** **Time: 9:00 – 12:00 PM**
**Subject: 230-434 – Safety** **Room: R300**
**(Safety in Chemical Engineering Operations)**

---

*ทุจริตในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา*

**Instructions: There are a total of 5 parts 12 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 | 20 | |
| II | 45 | |
| III | 40 | |
| IV | 60 | |
| V | 15 | |
| Total | 180 | |

**Exam prepared by**
**Ram Yamsaengsung**
**February 10, 2007**

**PLEASE CHECK TO MAKE SURE THAT**
**YOU HAVE ALL 12 PAGES OF THE EXAM BEFORE BEGINNING**
**(not including the cover sheet).**
**GOOD LUCK!**

# Prince of Songkla University
# Faculty of Engineering

**Final Exam, Semester II** **Academic Year: 2006 – 2007**
**Date: February 19, 2007** **Time: 9:00 – 12:00 PM**
**Subject: 230-434 – Safety** **Room: R300**
**(Safety in Chemical Engineering Operations)**

---

**CLOSED BOOK SECTION (No books or notes allowed)**

**I. Fill in the blanks (20 points)**

1. If there are some workers trapped inside the building, the 3 main tasks of emergency services team are _____, _____, and _____.
2. The _____ have the responsibility of assisting the orderly evacuation of the building.
3. Upon discovering a major vapor or liquid escape of a hazardous material, persons should _____ and leave immediately.
4. _____ should leave the building immediately upon hearing the fire alarm.
5. The _____ should be designated in a safe place in the open air where workers evacuating can meet.
6. Tanks containing _____ have a red band and tanks that contain _____ have yellow band.
7. After spillages, areas should be cleaned and _____ for at least _____ minutes.
8. Fire fighters, rescuers, first-aid providers are all _____ and will work under the direction of the _____ and later the _____.
9. The first-aid box should be provided in laboratories and should be located near the _____ with a list of trained personnel alongside.
10. A communicating door must be able to provide fire resistance for at least _____.
11. An _____ is used to prepare workers for emergencies such as the release of toxic gas.
12. The _____ will relieve the lab superintendent of the responsibility of main control and direct the shitting down and evacuation of the laboratory.
13. 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.
14. It is essential that the design pressure of pressure vessels should not be exceeded, the _____ must be clearly marked on all vessels.

## II. Shorts Answers (45 points)

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

2. 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)**

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

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

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

6. What are the components necessary for a dust explosion to occur? **(5 points)**

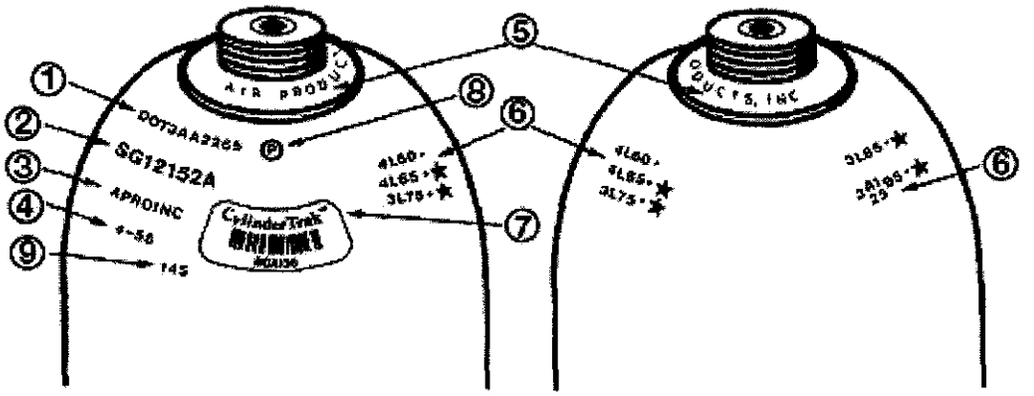
7. When working with machineries or moving parts, how must the machines be chosen? **(2 points)**

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. **DOT3AA4000**
2. **SG12152A**
3. **GASINC (Registered Symbol of Gas Inc.)**
4. **6-60**
5. **Faculty of Engineering**
6. **7L00 +★**
7. **Cylinder Tank Bar Code Label – BGA136**
8. **Cylinder Manufacturer's Inspection marking**
9. **TW 150**

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

4. What is the title of your semester case study project? Name 4 other semester projects that were presented by your classmates. **(5 points)**

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

6. Match the following information with the article that it was from? **(10 points)**

**(a) Time Sensitive Chemicals**
**(b) Pressure Relief Systems – Do you see an hazards here?**
**(c) Mechanical Integrity**
**(d) Dust Explosion Hazards**
**(e) Is this valve open?...or closed?**
**(f) Overfilling Tanks – What Happned?**
**(g) Do you store cylinders properly?**

**____ 1. The discharges from relief valves are directed toward a personnel access platform and toward an area where people could be working**
**____ 2. A flange and a control valve are badly corroded, causing a high possibility of leakage.**
**____ 3. Any open pipe is a potential chemical discharge!**
**____ 4. Chemicals have a "shelf life" and become unstable or reactive after expiration date.**
**____ 5. Accumulations of dust layers on floors and vessels can form an explosive dust cloud once suspended in air.**
**____ 6. A large quantity of flammable liquid was released because operations personnel mistakenly believed the valve was closed.**
**____ 7. Dozens of cylinders exploded causing spreading fire in a hot summer day in St. Louis, USA.**
**____ 8. A level gauge did not work properly leading to large explosion in Buncefield Oil Storage Depot in England.**

**____ 9. Regular plant tours to look for problems such as inadequate piping support and small leaks or wet spots around flanges should be conducted.**
**____ 10. Particles such as wood, flour, sugar, grain, plastics, and solid organic chemicals, and metals, if small enough, can explode.**

**Name:** _____ **Student ID** _____

# Prince of Songkla University
# Faculty of Engineering

**Final Exam, Semester II** **Academic Year: 2006 – 2007**
**Date: February 19, 2007** **Time: 9:00 – 12:00 PM**
**Subject: 230-434 – Safety** **Room: R300**
**(Safety in Chemical Engineering Operations)**

---

**OPEN BOOK SECTION (You can use the Case Studies and HAZOP Handout)**

**IV. Short Answers (60 points)**

1. Discuss 4 reasons why a company does not want any accident to take place? **(4 points)**

2. If an existing plant must undergo HAZOP, who should be included in the HAZOP team? **(3 points)**

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 types of material are recommended for Acids and Alkalies resistance? **(3 points)**



**Congratulations and Have a Good Summer!!!**

13. What are the 3 fluid properties that must be considered in thermal fluid systems? If a system circulates 600 gal of fluid with a thermal expansion of 0.06 gal/gal of fluid per 100°F temperature rise and operates at 520°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 (15 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? **(15 points)**

---

**Congratulations and Have a Good Summer!!!**