Name: _____ Student ID _____

Prince of Songkla University
Faculty of Engineering

Exam: Mid-Term, Semester I | **Academic Year: 2009 – 2010**
Date: August 2, 2009 | **Time: 1:30 – 4:30 PM**
Subject: 230-334 – Safety | **Room: Robot**
(Safety in Chemical Engineering Operations)

ทุจริตในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Points Distribution (For Grader Only)		
Part	**Points Value**	**Score**
I	35	
II	50	
III	15	
IV	55	
Total	155	

Exam prepared by
Ram Yamsaengsung
July 29, 2009

PLEASE CHECK TO MAKE SURE THAT
YOU HAVE ALL 7 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 (35 points)

1. The _____ acts as the secretary of the laboratory safety committee.
2. _____ should be worn when working with toxic and _____ chemicals.
3. To produce a fire, it is necessary to have _____, _____, and _____. This is also known as _____.
4. For high pressure equipment, the safety devices that must be installed include _____, _____, and _____.
5. The _____ ensures that equipment used in work under their direction is of safe design and construction.
6. The _____ maintains proper keeping of all documents, calculations, reports, procedures and operational logs.
7. The _____ acts as the chairperson of the laboratory safety committee.
8. The safety policy of the Department of Chemical Engineering must be signed by the _____.
9. If organic solvents are used for cleaning equipment, the work (cleaning) should be done in a _____.
10. The _____ appoints the laboratory safety officer and is usually the head of the department.
11. The _____ acts as a liaison with the site safety officer, inspectors of the Health and Safety Executive, and insurance inspectors.
12. _____ are highly toxic by ingestion and are rapidly absorbed by the skin producing intensive burns.
13. A signature on behalf of the _____ must be present on the safety policy.
14. In a well design facility, the equipment should only take up about _____% of the entire floor space.
15. An inflammation of the skin that causes an allergic reaction is called _____.
16. The _____ maintains scheduled and recorded inspection, examination, repair and replacement according to statutory, organization, and insurance requirements.
17. For vibration and noise, damage occurs at about _____db, for a short period of exposure and _____ db for continuous noise.

18. The sudden release of vacuum is called _____.
19. Phenol, Cresol, and _____ are very dangerous _____.
20. The five components needed for a dust explosion to are_____, _____, _____, _____, and _____.
21. The _____ needed must be LISTED, this will include fire fighting equipment, fire alarms, first-aid boxes, emergency shower and emergency telephone lines.
22. Two types of human indiscipline that could cause hazards include _____ and _____.

II. Shorts Answers (50 points)

1. List 2 different methods for treating the effluents leaving the facility. **(2 points)**

2. Name 5 things that must be included in a general safety policy. **(5 points)**

3. Name 4 major dangers from electrical hazards. **(4 points)**

4. With long term exposure to toxic hazards, what are the damages that may be caused to the body? **(2 points)**

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

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

7. List 5 emergency facilities (or equipment) that must be listed in the labs? **(5 points)**

8. Discuss the major steps in a design of a laboratory. What questions must be considered? Why should a lab be modernized? What is a typical option in which modernization can be implemented? **(8 points)**

9. From the Fire Training hosted by the Hat Yai Fire Department, discuss ALL the different scenarios presented and ways of handling them (for example: gas tank leak with and without regulator). Make sure you mention all the **training techniques** that you were taught. **(10 points)**

10. Read the article below and answer the following questions? **(6 points)**

Overfilling Tanks – What Happened?

September 2006

Photograph courtesy of Royal Chiltern Air Support Unit

On Sunday December 11, 2005, gasoline (petrol) was being pumped into a storage tank at the Buncefield Oil Storage Depot in Hertfordshire, England. At about 1:30 AM a stock check of the tanks showed nothing abnormal. From about 3 AM, the level gauge in one of the tanks recorded no change in reading, even though flow was continuing at a rate of about 550 cu. meters/hour (2400 US gallons/minute). Calculations show that the tank would have been full at about 5:20 AM, and that it would then overflow. Pumping continued and the excess gasoline overflowed from the top of the tank and cascaded down the sides, forming a liquid pool and a cloud of flammable gasoline vapor. At about 6:00 AM the cloud ignited and the first explosion occurred, followed by additional explosions and a fire which engulfed 20 storage tanks. Fortunately there were no fatalities, but 43 people were injured. 2000 people were evacuated, there was significant damage to property in the area, and a major highway was closed. The fires burned for several days, destroying most of the site and releasing large clouds of black smoke which impacted the environment over a large area.

10.1 What caused the accident? (2 point)

10.2 When and what type of explosion took place? (2 point)

10.3 What should have been done to prevent the accident? (2 points)

III. CSB Video (15 points)

1. Match the following information with the safety video that it was from? **(15 points)**

(a) Reactive Hazards
(b) Death in the Oil Field

____ 1. Maintenance workers were killed when they tried to clean out plastics from a waste tank.
____ 2. Highly toxic gas was released due to improper scale-up of process.
____ 3. A ladder was used as a platform during "Hot Work" operation.
____ 4. Three maintenance workers were killed during a welding operation.
____ 5. A 12% increase in production caused a runaway reaction leading to the release of acrylic vapor clouds and a violent explosion.
____ 6. A lid acetylene torch was inserted into a storage tank to test for the presence of hydrocarbons.
____ 7. Slow decomposition took place releasing large amount of gas and increasing the internal pressure inside of a waste storage tank

2. Describe the major causes in the tragedy from the Death in the Oil Field video. (8 points)

IV. Discussions (55 points)

1. Using the attached diagram of a typical R&D facility layout (Fig.1), write where the following should be located: the service vehicles, the parking space for the employees and visitors, the office area, the workshops, store area, low hazards materials, high hazards materials, laboratory, control equipment, high hazard experimental area, and restricted area. **(10 points)**

   See attached diagram for solution.

2. Name 10 types of hazards that are found in our Chemical Engineering Department. Give specific examples of each (i.e. the slippery, greasy floor of the vacuum frying unit is a hazard). An example cannot be used more than once. Also give one way to prevent each hazard from occurring. **(15 points)**

3. From the Lab Layout assignment, list at least **two potential dangers** in each lab, and **two suggestions** recommended in your report to make it safer. **There were 10 labs presented. (30 points)**

CONGRATULATIONS! END OF EXAM!

Designing R&D Facilities

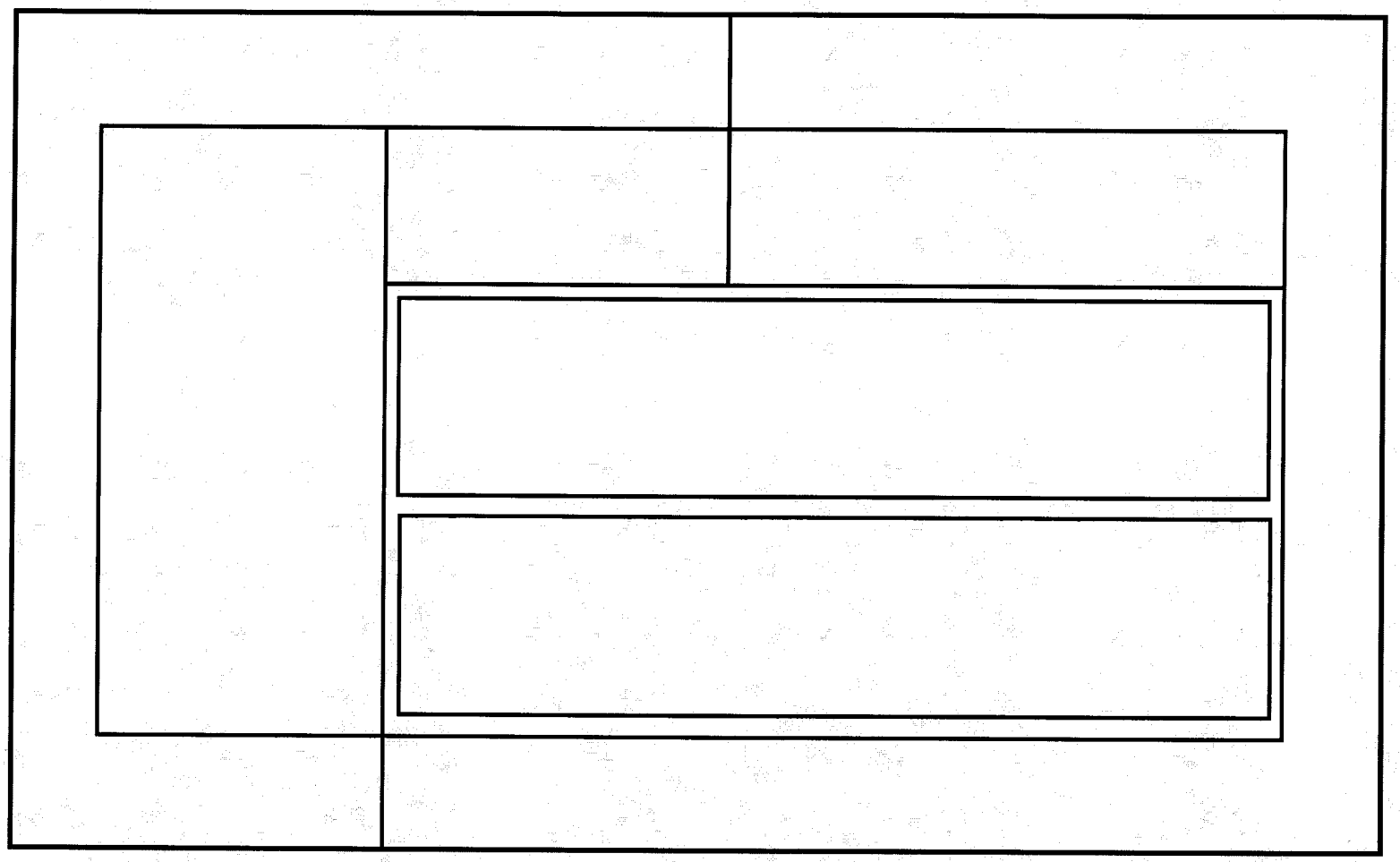

Fig. 1: Typical R&D facility layout