Name:	•	Student	ID

Prince of Songkla University Faculty of Engineering

Exam: Mid-Term, Semester II

Academic Year: 2006 - 2007

Date: December 20, 2006

Time: 9:00 – 12:00 PM

Subject: 230-434 - Safety

Room: R201

(Safety in Chemical Engineering Operations)

ทุจริตในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Instructions: There are a total of 3 parts 9 pages (not including the cover sheet). Place your name and the student ID number on every page. Students are allowed to use <u>only</u> a pen or pencil and an English dictionary (Talking Dictionary is permitted). No exams are allowed to leave the room.

Points	Points Distribution (For Grader Only)		
Part	Points Value	Score	
I	35		
II	60		
HII	55		
Total	150		

Exam prepared by Ram Yamsaengsung December 14, 2006

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 (35 points)

1.	The appoints the laboratory safety officer and is usually the head of the department.
	the head of the department.
2.	The acts as the secretary of the laboratory safety committee
3.	The is responsible for arranging inspection of the storage
	materials. The inspection should be conducted every
4.	The ensures that equipment used in work under their
	direction is of safe design and construction.
5.	The safety policy of the Department of Chemical Engineering must be signed by
	the
6.	
7.	To produce a fire, it is necessary to have,, and
	. This is also known as
8.	. This is also known as If organic solvents are used for cleaning equipment, the work (cleaning) should be
	1 .
9.	Cobalt (27) and are two examples of .
10.	Cobalt (27) and are two examples of are highly toxic by ingestion and are rapidly absorbed by the skin producing intensive burns.
	skin producing intensive burns.
11.	A signature on behalf of the must be present on the safety policy.
12.	In a well design facility, the equipment should only take up about % of
	the entire floor space.
13.	An inflammation of the skin that causes an allergic reaction is called
14.	should be worn when working with toxic and
	chemicals.
15.	The sudden release of vacuum is called
16	Phenol, Cresol, and Xylenol are very dangerous
17.	For high pressure equipment, the safety devices that must be installed include
	· · · · · · · · · · · · · · · · · ·
18	HAZOP is an abbreviation for which is a safety
•0.	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.
10	Metal containers should have about % extra space to allow for liquid
17.	
	expansion.

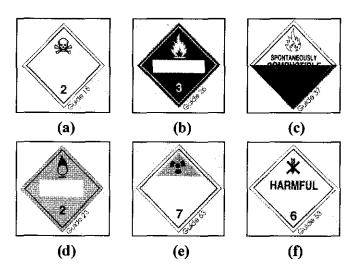
20. The storage of bulk amount of toxic and chemical liquids is preferably stored in
21. The preferred method of stacking drums in the open air is to stack them
22. LPG is an abbreviation for and must be stored in properly designed vessels, in which at least unfilled space must be allowed to prevent the development of dangerous pressure. 23. Experiments can be classified as and
 24. The lowest temperature at which a smallest amount of heat can cause the chemical to enter vapor phase and become ignited into flame is called the 25. It is essential that the of pressure vessels should not be exceeded, and the must be clearly marked on all vessels.
II. Shorts Answers (60 points)
1. What is the name of the city in Texas that has a major ozone problem (Dallas, Houston, Texas City, or Austin)? How much time does a plant manager have to get rid of black smoke (plumes) from his flare? What is the generally used to get rid of the black smoke? (4 points)
2. What is the name of the city where a BP plant exploded? How much money did the company have to pay up? (2 points)
3. Name 4 basic ways to prevent a fire in home and office. (4 points)

4.	Name 4 ways of extinguishing a fire. (4 points)
5.	Which type of fire is the following: (Type A, B, C, or D) (4 points)
	Metallic fire such as magnesium
	Gas or oil fire Fire involving paper, wood, cloths
	Electrical Fire
6.	Name 4 things that must be included in a general safety policy. (4 points)
7.	Name 4 major dangers from electrical hazards. (4 points)
8.	With long term exposure to toxic hazards, what are the damages that may be
	caused to the body? (2 points)
9.	What are the 2 types of human indiscipline mentioned that could cause hazards to
	others? (2 points)

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

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

- 12. When working with machineries or moving parts, how must the machines be chosen? (2 points)
- 13. Identify the following symbols. (6 points)
 - (a)
 - **(b)**
 - (c)
 - (d)
 - (e)
 - **(f)**



13. Read the article below and answer the following questions? (8 points)

Thai factory explosion kills 35 workers

By Steve Dean 9 October 1999

A large explosion at the Hong Thai Kaset Pattana fruit processing plant in Thailand on September 19 flattened the buildings, killing 35 workers and injuring over 100. More than 40 people are still unaccounted for. Two explosions ripped apart the factory complex near the northern Thai city of Chiang Mai and created a 30-metre wide crater. Bricks and large lumps of concrete were spread over a four-acre area. The blasts were caused by the ignition of a stock of the volatile chemical, potassium chlorate, illegally stored in the plant.

Debris landed over a mile from the plant, the roof of a nearby temple was blown off and houses in a one and a half-mile radius from the factory were damaged. A further disaster was only averted by seconds when firefighters extinguished flames around two 5,000-litre oil tanks in the factory grounds.

Police have said that up to 10 tonne of potassium chlorate was stored at the plant without a license. The chemical is extremely dangerous if not handled and stored correctly. It is highly explosive and is used in the manufacture of gunpowder and other explosives for fireworks, hand grenades, and landmines. It is flammable, combustible and highly unstable when mixed with substances such as sulphur.

- 13.1 What caused the accident?
- 13.2 What is this chemical usually used for?
- 13.3 What did the farmers in the area used it for?
- 13.4 What was stored in the factory area that would have caused further disaster?

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

Oil slick threatens Pattaya beaches

By Anchalee Kongrut and Assawin Pakkawan November 21, 2005

Chon Buri An oil slick about 3km long containing about 100,000 litres of crude could be heading for Pattaya after a pipe on an unloading Japanese oil tanker ruptured yesterday, leading to a large spill. The Ryuho Maru was discharging a load of crude oil from Oman at a buoy about three nautical miles off Udom cove when the accident Officials inspect a boom set to contain occurred.

It took about 30 minutes to shut the valve, and by spilling about 50 tonnes of crude oil into then about 100,000 litres of oil, or a third of the pattaya.—JERDSAK tanker's cargo, had spilled into the sea.



spilt oil off the coast of Si Racha district, Chon Buri, yesterday. A pipe burst as the tanker Ryuho Maru was unloading, SANGTHONGCHAROEN

The Marine Department has ordered an investigation to establish whether the tanker's crew had mishandled the transfer, or if a faulty pipe was to blame.

The oil was being transferred to the Thai Oil refinery plant in Si Racha district.

The tanker threw a floating boom around the slick in a futile attempt to contain its spread. Strong winds and choppy seas pushed the oil slick over the top of the boom and were still hampering clean-up efforts last night.

A Marine Department official said the situation should be under control in a few days. The department would send in the Chontharanurak, a vessel used specifically to battle oil spills. If necessary a second vessel, the Den Suthi, would be dispatched from nearby Samut Prakan.

- 14.1 How much crude oil was spilled into the sea?
- 14.2 What may have caused the accident?
- 14.3 How will the government treat the oil spill?

III. 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)

2. 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? (10 points)

3. 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. (20 points)

4.	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) Where did we practice fire fighting? (1 point)
5.	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. (4 points)

CONGRATULATIONS! END OF EXAM!

Designing R&D Facilities Fig. 1: Typical R&D facility layout