

Name: _____ Student ID _____

Prince of Songkla University
Faculty of Engineering

Exam: Mid-Term, Semester II

Academic Year: 2005 – 2006

Date: December 16, 2005

Time: 1:30 – 4:30 PM

Subject: 230-476 – Safety

Room: A401

(Safety in Chemical Engineering Operations)

ทฤษฎีในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทฤษฎี 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 only a pen or pencil and an English dictionary (Talking Dictionary is permitted). No exams are allowed to leave the room.

Points Distribution (For Grader Only)		
Part	Points Value	Score
I	25	
II	70	
III	55	
Total	150	

**Exam prepared by
Ram Yamsaengsung
December 8, 2005**

**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 (25 points)

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

6. What are the components necessary for a dust explosion to occur? **(5 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. Match the following information with the article that it was from? (10 points)

- (a) **Reactive Chemistry: Not always when or where you want it!**
- (b) **What? No Spark?**
- (c) **A “Good Idea” Can Turn Bad...when you ignore Management of Change**
- (d) **Interlocked for a Reason...a Very Good Reason!**
- (e) **Static Electricity + Flammables + Air = ??**
- (f) **Simple Mixing Chemicals...can be Hazardous to your Health**
- (g) **Dust did This?**
- (h) **Don't pop your top...**
- (i) **But the pressure rating was okay...!?**

- ___ 1. **Pipe FULL of peroxide**
- ___ 2. **The air purge system was not interlocked to the sieve operation**
- ___ 3. **A second explosion took place**
- ___ 4. **A fire water system was used in the operation**
- ___ 5. **Beads containing trace amounts of pentane falling through sieve**
- ___ 6. **A heater exploded because the operator skipped one of the operating procedure**
- ___ 7. **An exothermic reaction took place when organic materials passed through activated carbon**
- ___ 8. **Draining oil from a large gear box using an air hose**
- ___ 9. **A worker did not study the MSDS and his hand was severely burned**
- ___ 10. **The instrument failed because it could not withstand the steam pressure at the elevated temperature trays**

12. From a News article presented in class, what type of factory did the WORST accident in Thai history took place in Bangkok killing 188 people on May 10, 1993? (2 points)

13. What was the recent accident that took place in Pattalung? What was spilled from it and what are the dangers of that chemical? What area in Pattalung are environmentalists most worried about? (4 points)

14. What was the cause of the oil spill off the coast of Chon Buri this past November? Which company was the oil being transported to? What damages can the oil spill cause to the environment? What cleanup technique was used? **(4 points)**

15. 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.

- 15.1 What caused the accident?
- 15.2 What is this chemical usually used for?
- 15.3 What did the farmers in the area use it for?
- 15.4 What was stored in the factory area that would have caused further disaster?

16. Identify the following symbols. (6 points)

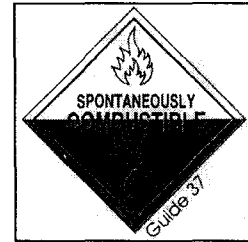
- (a)
- (b)
- (c)
- (d)
- (e)
- (f)



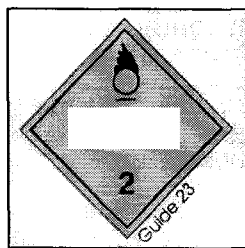
(a)



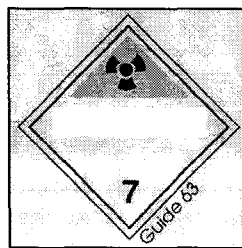
(b)



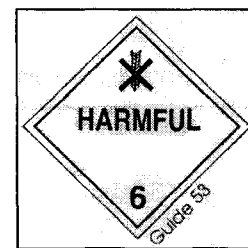
(c)



(d)



(e)



(f)

3. Name 6 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. **(12 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 **3 labs** that were presented by you and your classmates, mention at least **two potential dangers** in each lab, and **two suggestions** recommended by the presenter for each lab to make it safer.
(12 points)

CONGRATULATIONS! END OF EXAM!

Designing R&D Facilities

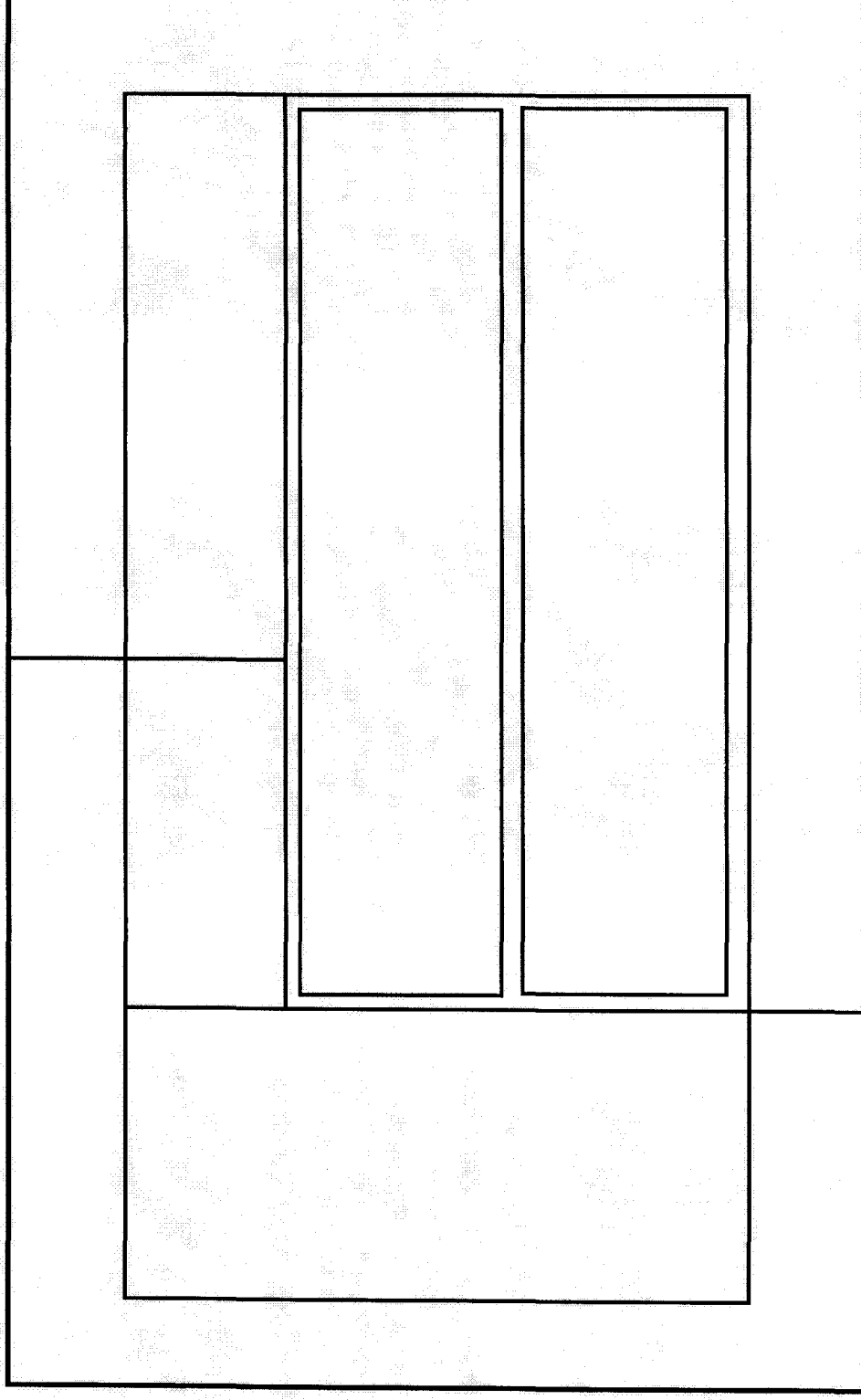


Fig. 1: Typical R&D facility layout