

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualification:–

M.Eng.

Chemical Eng E876: Advanced Safety and Loss Prevention

COURSE CODE : CENGE876

UNIT VALUE : 0.50

DATE : 17–MAY–06

TIME : 10.00

TIME ALLOWED : 3 Hours

*Answer **FOUR** questions only, with **NO MORE** than two questions from each Part. Only the first 4 questions answered will be marked. Marks are allocated as shown []. Answers to parts A and B must be given in separate answer books.*

PART A

1.
 - a) Describe the main features of a permit to work system. [10]
 - b) List the types of work that would require the issue of hot work permits, and confined entry permits, and any particular features these may have. [10]
 - c) Briefly describe a major accident where failure of the permit to work system was a prime factor, and list the main failings. [5]

2.
 - a) List and explain the key elements of a health and safety management system. [12]
 - b) Describe the differences between re-active and pro-active systems for monitoring health and safety performance, and explain which, in your opinion, is the more effective and why. [13]

3.
 - a) Describe the essential steps in risk assessment. [8]
 - b) The gas/condensate pipeline pig receiver shown in figure 1 is to be opened so that the pig can be removed. Carry out a risk assessment to enable the work to be carried out safely. [12]

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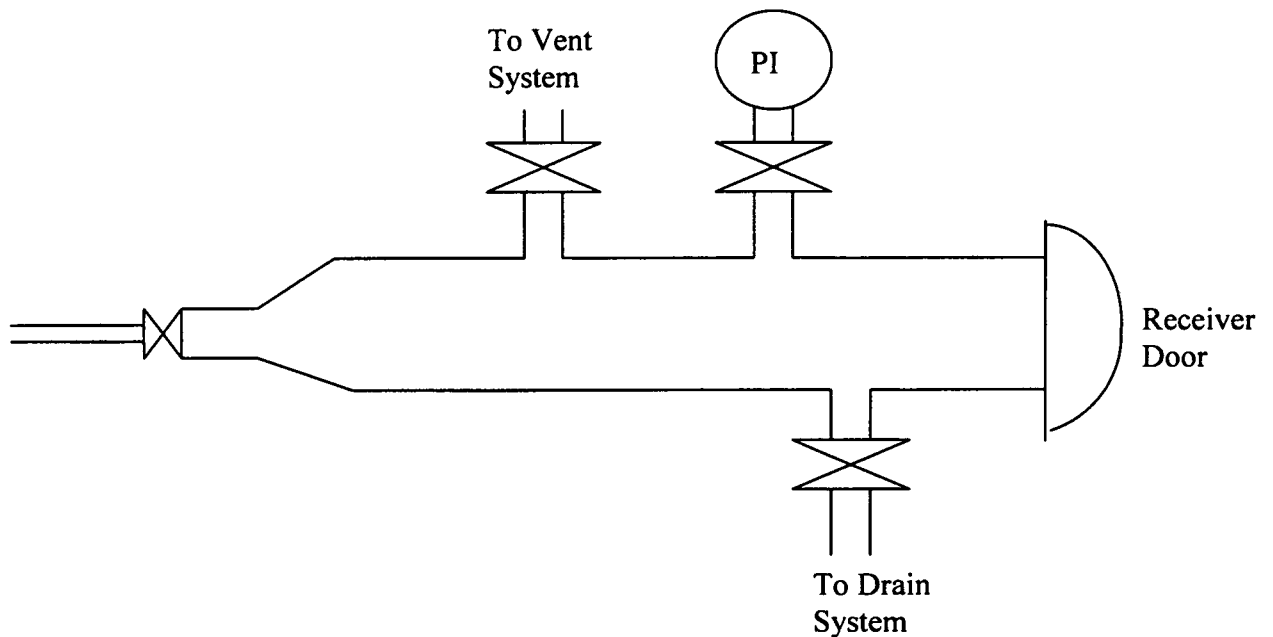


Figure 1
Schematic representation of the gas/condensate pipeline pig receiver

PART B

4.

The Safety Case Regulations require that in any Offshore Safety Case submission to the Health & Safety Executive, Major Hazards are identified and assessed. Further they require that risks they give rise to are evaluated and rendered ALARP.

- a) Distinguish between 'Major Hazards' and 'Occupational Hazards' giving four examples of each. [9]
- b) Explain what you understand by 'risk' and how it is different from 'hazard' [6]
- c) What does ALARP mean? [2]
- d) Describe an established 'quantitative' methodology that can assist in demonstrating ALARP. [8]

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5.

- a) An escape of a flammable material can give rise to a number of hazards
- i) What are they? [4]
 - ii) Where relevant, give values for the intrinsic intensities of the effects generated. [4]
 - iii) How they should be mitigated to avoid escalation of an incident and help preserve life [4]
- b) The 'Prevention of Fire and Explosion, and Emergency Response Regulations' (PFEER) were developed in direct response to the Piper Alpha disaster in 1988.
- i) Explain their intent and applicability. [5]
 - ii) Five 'appropriate measures' are defined whereby hazards are to be identified, assessed, and ultimately reduced to ALARP; what are they? [8]

6.

- a) Describe what is meant by Availability from the process safety point of view by expressing it in terms of a simple expression carefully explaining the terms used. [5]
- b) A pressurised vessel is protected against over-pressure using two pressure switches that terminate the feed flow using an emergency shutdown valve.
- i) For the above set up, draw the corresponding process and instrumentation flow as well as the availability block diagrams based on 1002 and 2002 voting systems using the higher availability pressure switch. [5]
 - ii) Calculate the corresponding availabilities for the above two modes of operation and comment on your results. You may employ the following values for the two pressure switches, PS1 and PS2

	100 x Failure rate (yr^{-1})	Proof test interval (days)
PS1	10	30
PS2	20	20
ESDV	40	60

[7]

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- iii) Given the same failure rate and proof test interval of 0.1 yr^{-1} and 30 days respectively for the two pressure switches calculate the corresponding availabilities for the 1002 and 2002 voting systems. Comment on any differences you obtain between these new availabilities and those obtained in part (b) above. [8]

END OF PAPER