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	:	**10-MAY-05**
TIME	:	**10.00**
TIME ALLOWED	:	**3 Hours**

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*Answer **FOUR** questions only with **no more than TWO** questions from **each SECTION**.*
*ALL questions carry a total of **25 MARKS** each, distributed as shown [ ].*
Answers to sections A and B are to be provided in separate answer books.

SECTION A

1.

Describe the Accident Model and demonstrate its application with a notable accident of your choice. [25]

2.

(a) List the principal approaches to protect against overpressure for any system subject to internal pressure. [3]

(b) What are the advantages and disadvantages of using bursting discs? [10]

(c) The Discharge Scrubber V-203 shown in Figure 1 (next page) receives gas from a high pressure gas compression train at 62 barg and 60°C. The primary purpose of the scrubber V-203 is to separate any entrained liquids in the gas stream and prevent it from entering the High Pressure gas export system.

What are the relieving scenarios that should be considered for sizing the relief valve RV-204 located downstream of the scrubber V-203. Give a brief explanation for the evaluation of each design case. [12]

3.

(a) Identify the necessary steps that should be followed for risk assessment. [8]

(b) Hazop studies are the most commonly used methods for identifying hazards.

(i)What are the key aspects to a successful Hazop study. [4]
(ii) Describe the advantages and limitations of the Hazop technique. [13]

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Question 2, Figure 1

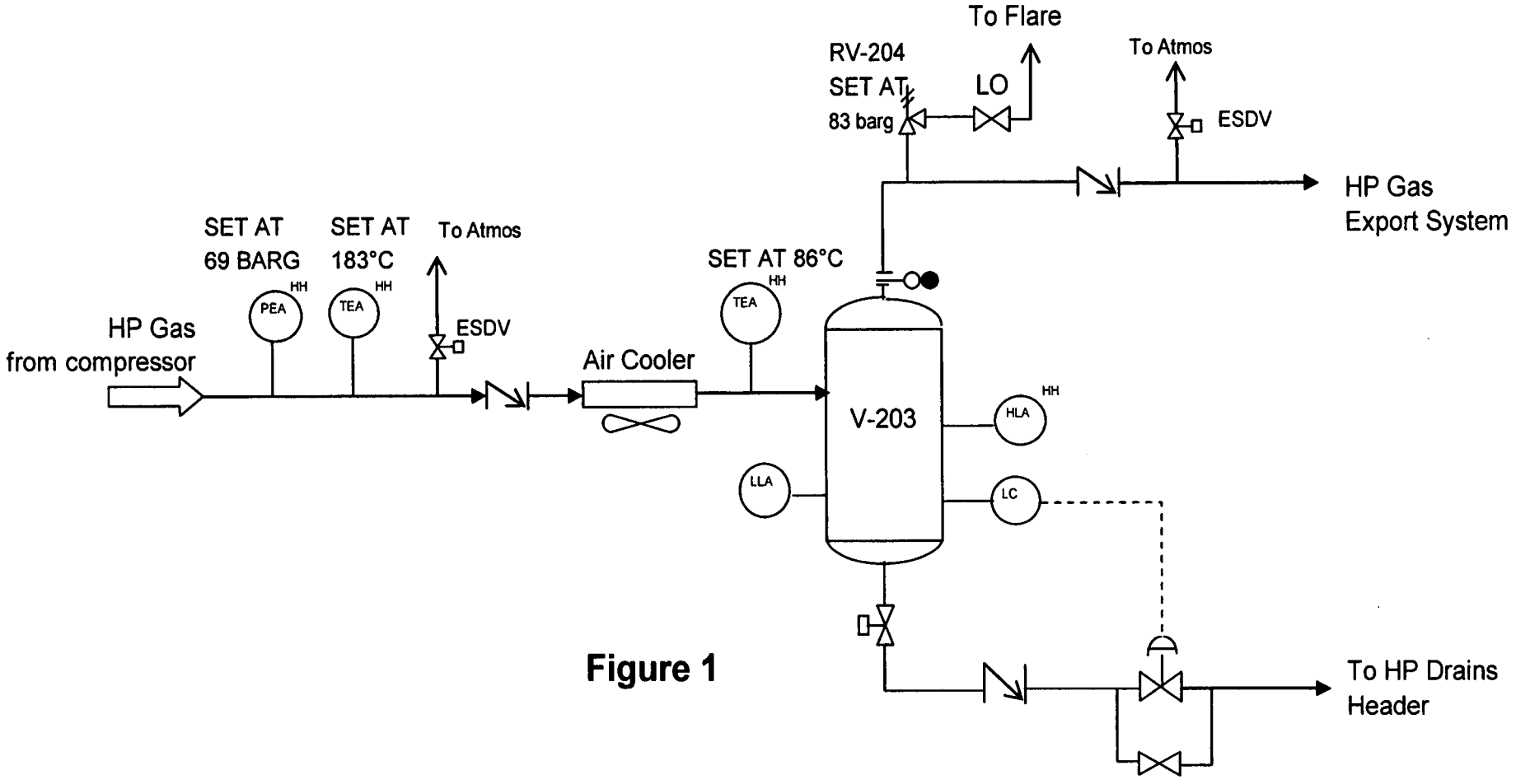

Figure 1

SECTION B

4.

a) Outline an approximate approach you would use to investigate the escalation potential of a gas filled process vessel subjected to a large jetfire. Assume that Emergency Shutdown (ESD) isolation and blowdown are available [10]

b) Illustrate the above by means of the following example involving a cylindrical vessel containing methane at 120 barg and 60 °C with the following specification

Internal diameter	= 2m
Wall thickness	= 80 mm
Surface area	= 80 m^2
Density	= 7850 kg/m^3
Specific heat capacity	= 460 J/kg°C
Ultimate tensile strength	= 460 N/mm^2 to 400°C then reducing linearly to 25 N/mm^2 at 800°C

Blowdown to API 521 in accordance with:

$$\ln\{P_o/P\} = 3.03\times10^{-3}\, t$$

where, P_o is the initial pressure and P, is the pressure at time t(sec)

Assuming immediate blowdown to 1 bara, calculate the approximate time to vessel failure and the corresponding internal pressure. [15]

5.

(i) Explain the process by which Quantitative Risk Assessment (QRA) is used to assist in the demonstration of As Low as Reasonably Practicable (ALARP) in the offshore oil and gas industry. What are the strengths and weaknesses of QRA? [12]

(ii) In a severe fire incident a 200m^3 manned control room is surrounded by fire that lasts 30 minutes. Assuming that it remains cool within but that fire products containing 2% carbon monoxide (CO) permeate the structure at a rate of 0.1m^3/min estimate, on the basis of "well stirred reactor" theory, the internal concentration of CO at the end of the fire. Could the 50% level of blood carboxyhæmoglobin saturation be exceeded? [13]

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6.

(i) Describe the main aspects of inherent safety and how it may be economically justified. [13]

(ii) Outline nine important factors controlling the risk of accidents in process plant. [12]

END OF PAPER