National Exams May 2016

04-Chem-B6, Petroleum Refining and Petrochemicals

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is an OPEN BOOK EXAM.

   Any non-communicating calculator is permitted.

3. FIVE (5) questions constitute a complete exam paper.

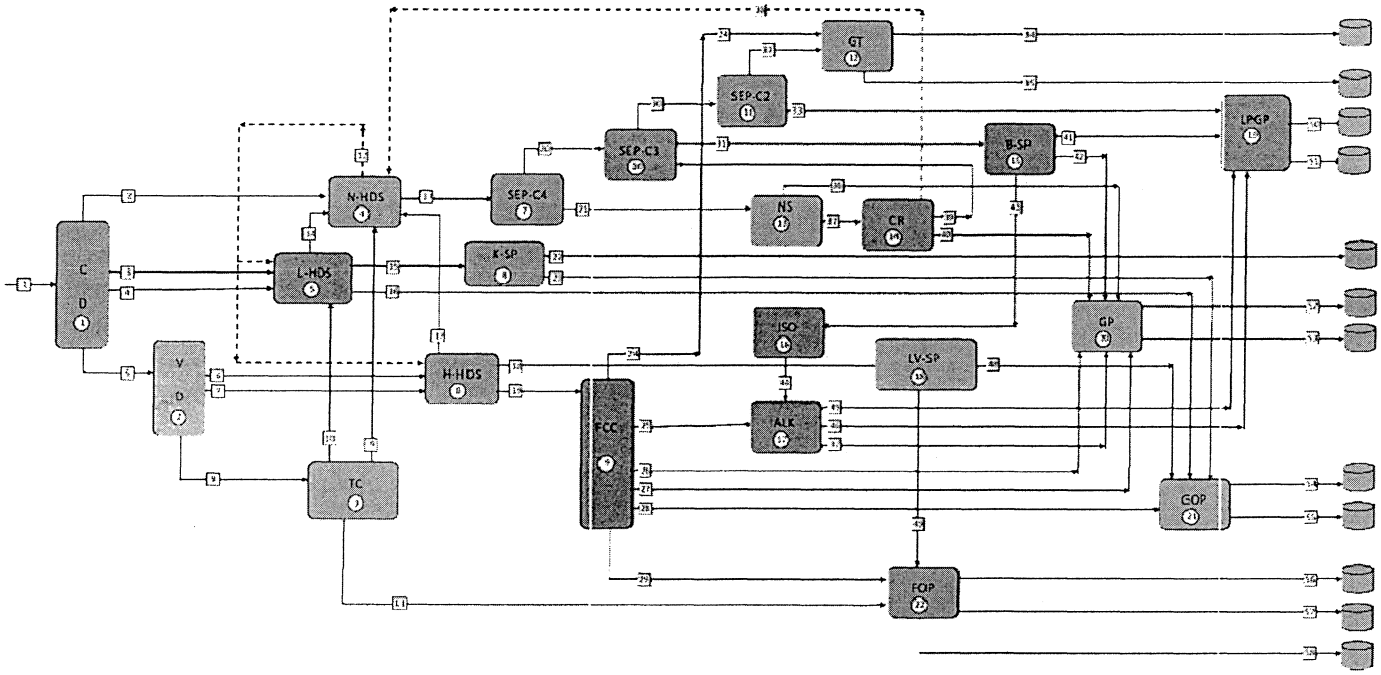
4. Each question is of equal value.

5. Most questions require an answer in essay format. Clarity and organization of the answer are important.

Question Number I *(10 Marks)*

The following schematic drawing represents the overall refinery process block flow diagram. Briefly and qualitatively, answer the followings:

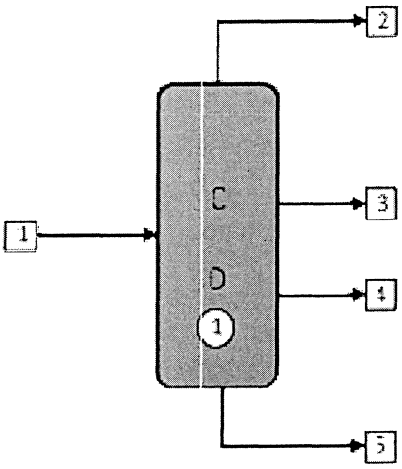
a) What do the dashed lines represent?
b) Name the streams number 34, 35 and 58?
c) What are the main differences between units number 3 and 9?
d) What is the purpose of CD and VD units?
e) What are the main differences between the CD and VD columns? Explain briefly!
f) Why the product of VD unit has to go to H-HDS unit before it enters the FCC unit?



Question Number II *(10 Marks)*

The following sketch shows the "black box" of the atmospheric distillation unit in a typical refinery. Answer the followings:

a) What is the main functional role of this unit?
b) What is the typical operating temperature and pressure of the distillation column in this unit?
c) Name the feed and the generated products?
d) What is the destination for streams 2 and 5, and what are their functional roles?
e) With the aid of drawing and brief descriptions, show the process flow diagram of this unit?

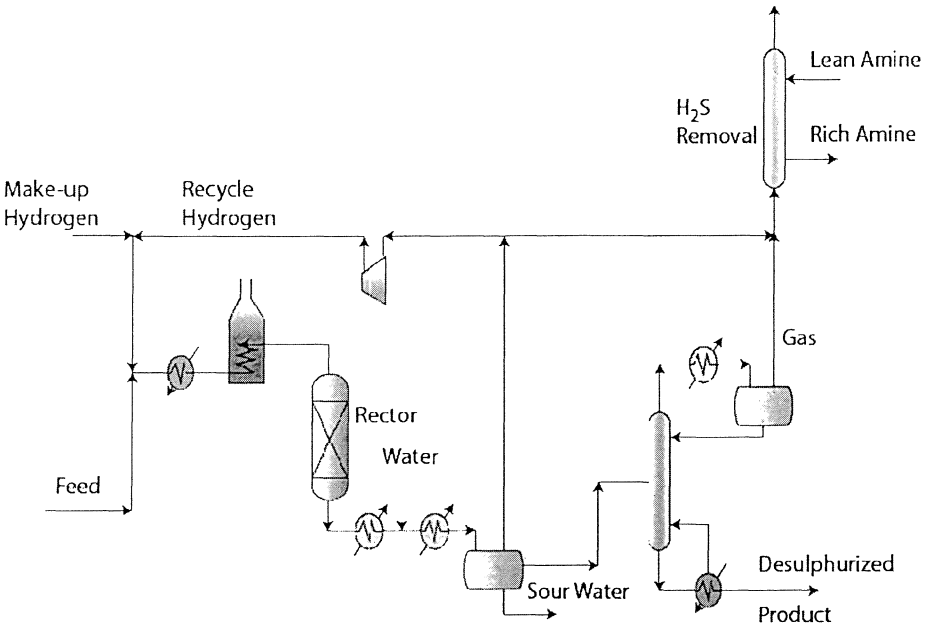


Question Number III *(10 Marks)*

A stream of crude oil has a molecular weight of 300000 kg/mol and a mean average boiling point of 350 °C. Estimate the followings:

a) The crude specific gravity at 60°F?
b) The crude gravity (API°) at 60°F?
c) Watson characterization factor?
d) Carbon to hydrogen weight ratio?
e) Is this crude oil paraffinic, naphthanic or aromatic? Explain, briefly and qualitatively.

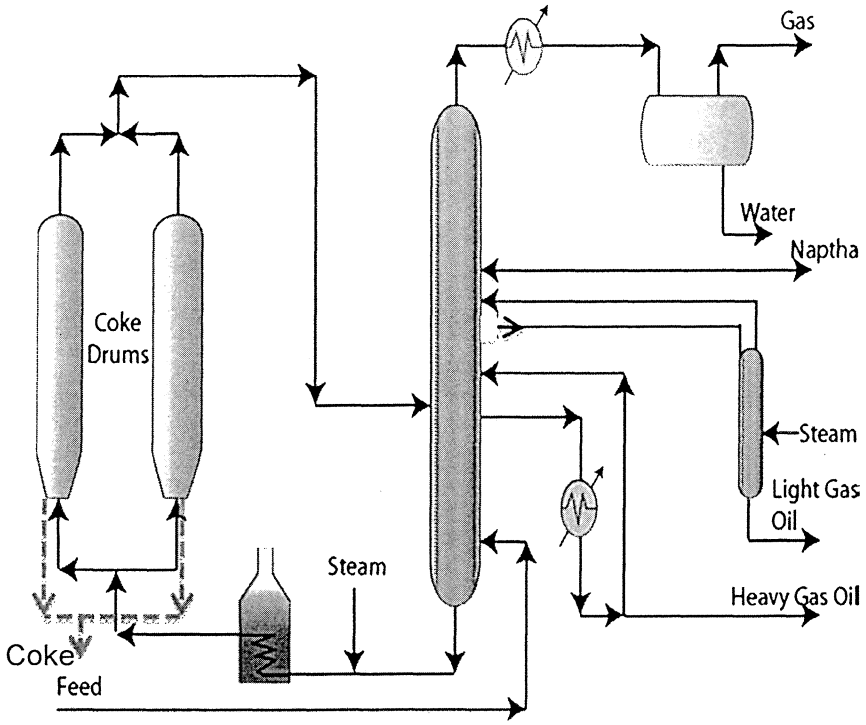
Question Number IV*(10 Marks)*
The following diagram is a typical flow sheet for a hydrotreating process in the petroleum refinery. Answer the followings:



1. What is the source of the feed?
2. What are the temperature and pressure of the reaction?
3. Is the reaction endothermic or exothermic?
4. What type of catalysts is used in this process for removing sulphur?
5. What are the three separate streams that are split out in the phase separator?
6. Why water is used in this process?
7. Why one heat exchanger is used before mixing with water and one is used after mixing?

Question Number V*(10 Marks)*

You are given the following flow sheet for one of a refinery unit. You have been asked to provide answers for the following questions:



1. Name the process?
2. What is the feed for this process?
3. What is the main purpose of this process?
4. What are the reaction time, temperature and pressure in the coke drums?
5. Why two, and not one, coke drums are used in this process?