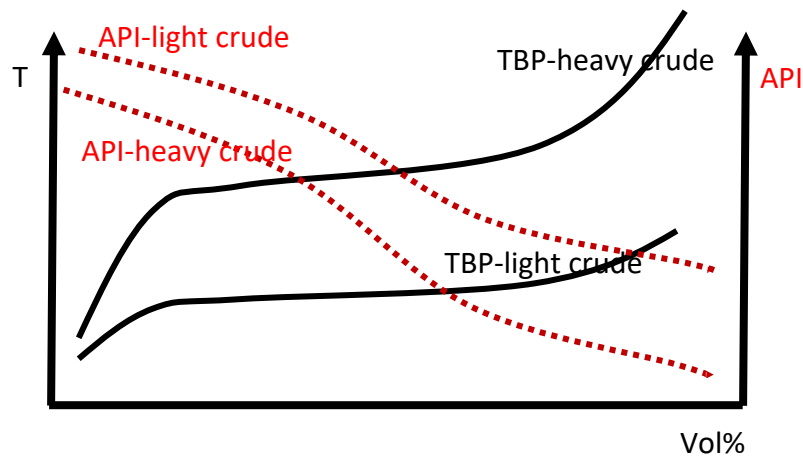


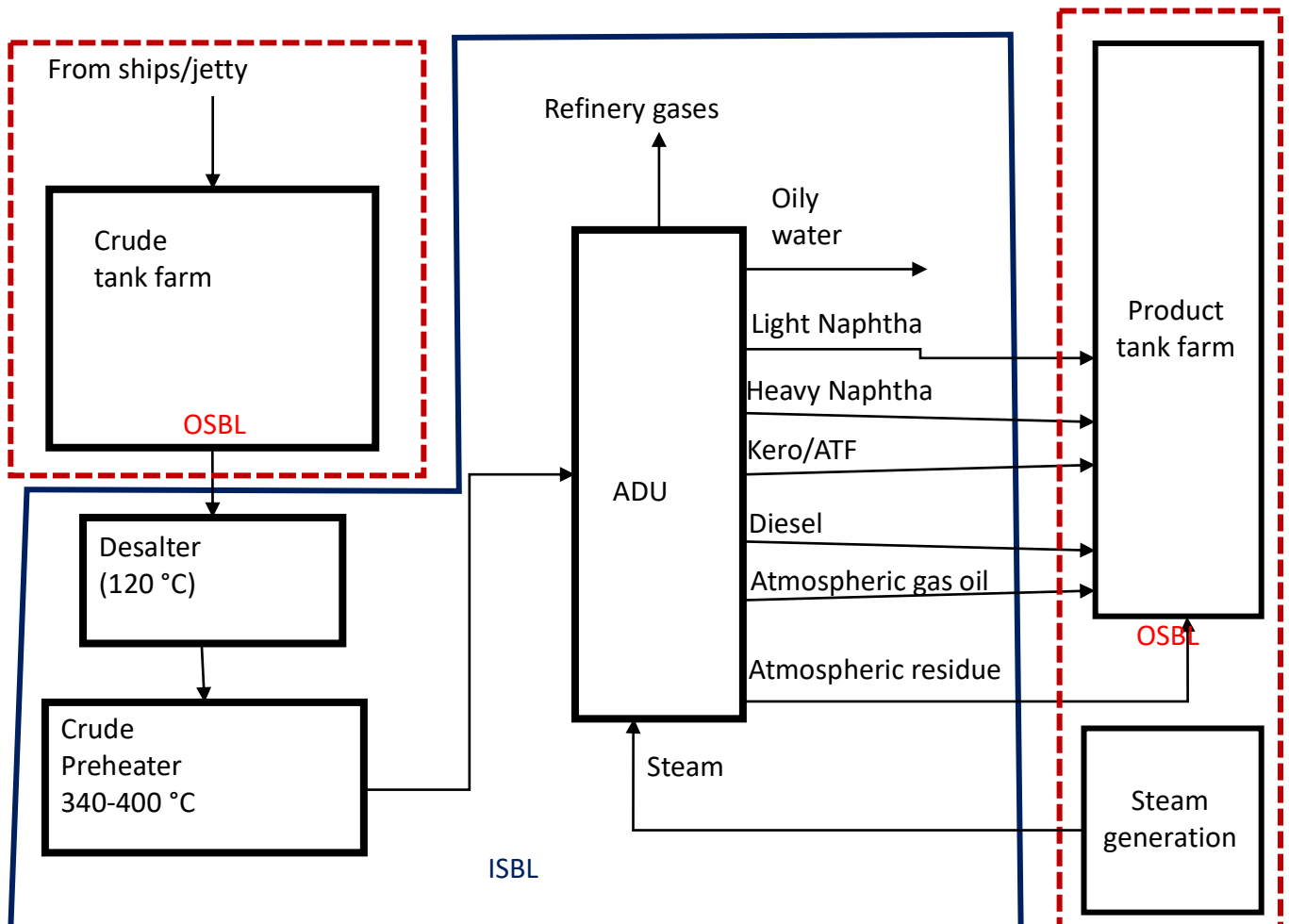
Name:

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1. Draw typical True Boiling Point curves for light and heavy crude oils. On the same plot, show how API gravity changes. Label axes, and clearly name the plot lines. (2 marks)



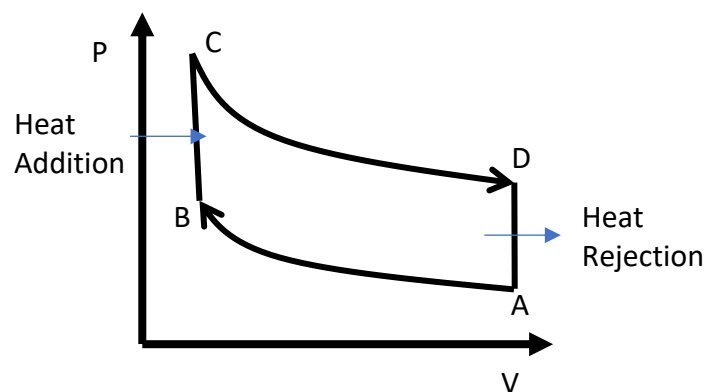
2. Draw the block diagram of a refinery where the received crude oil is separated into distillation cuts. Identify all material inlets and outlets. Mark the Inside battery limit (ISBL) and outside battery limit (OSBL) areas for this block diagram. (5 marks)



3. Match the following: (1 mark; no partial marking)

- | | | |
|----------------------|---|-------------------|
| a) Light distillate | → | i) n-Butane |
| b) Specialty product | → | ii) heavy naphtha |
| c) Middle distillate | → | iii) kerosene |
| d) Petroleum | → | iv) Engine Oil |

4. Draw the thermodynamic cycle (PV diagram) of a petrol engine. Label the states with your choice of the alphabet. At what thermodynamic state does auto-ignition occur in perfect and imperfect engines? (1 mark).



Auto-ignition does not occur in a perfect petrol engine. Typically, it is a spark ignition internal combustion engine. In an imperfect engine, auto-ignition occurs during the compression cycle (before spark ignition – before state B).

5. Kim plans to drive across the country. He stays in a hot place closer to the equator and plans to travel north to a chilly place that is not freezing. He planned the trip meticulously, carrying extra petrol from the starting point. As he approached the destination, his bike refused to start smoothly. Which fuel specification did he not pay attention to? (1/2 mark)

Reid vapour pressure. Higher RVP is necessary for cold weather.

6. What is a flash point? What are its units of measurement? (1/2 mark)

The minimum temperature at which fuel forms an ignitable vapour mixture with the air. Units of temperature ($^{\circ}\text{C}$, $^{\circ}\text{F}$, K).