Question Bank for petroleum chemistry

1. How did heavy oil become heavy?
2. How do the carbon and hydrogen content of Kirkuk and West-Qurna Basra cuts compare? What about sulfur and nitrogen?
3. Why is mercaptan sulfur, H_2S, and sulfur content in cuts important?
4. Where does the sulfur in crude oil come from?
5. What is the primary parameter used to describe the quality of crude oil? Why?
6. What is the difference between resins and asphaltenes?
7. Why is it necessary to know what lab procedure was used when referring to resin and asphaltene content?
8. Why is degraded oil short on alkanes?
9. Will crude oils in two wells in the same field have the same API gravity? What about in the same reservoir? Does crude gravity from a reservoir change over time?
10. What is the impact on a crude oils specific gravity and viscosity if oil is heavy in nature?
11. What are two differences between the sulfur and nitrogen content of crude oil?
12. Which crude oil will have a lower pour point: a waxy crude or an aromatic–intermediate oil?
13. Do the Basra sour and Taq-Taq sweet crude oils need to be desalted before running through a refinery?
14. What is the purpose of the UOP factor?
15. Why is carbon residue an important measurement for the feed of fluid catalytic cracking and delayed coking units?
16. Describe one practical effect viscosity has on crude oil production and in fuel and lubricant application.
17. Which of the following statements are true?
   a) Heavy oils are more susceptible to sludge formation due to their higher content of polar/asphaltic constituents.
   b) The viscosity of crude oils generally increases with the presence of asphaltenes.
   c) Crude oils with high pour point are waxier and tend to form material that enhance sludge formation.
   d) Crude oils with characterization factor greater than 12 are expected to form waxy deposits.

e) Crude oils with characterization factor lower than 10 are expected to have high polyaromatic hydrocarbons.

f) The CH ratio of naphthenes is usually lower than asphaltenes.

g) A low pour point means that the paraffin content of the crude oil is low.

h) Viscosity measurement is expressed in terms of kinematic viscosity in centistokes.

i) The carbon residue indicates the asphalt content of crude oil.

j) Most of the metals in crude that are not volatized during distillation are concentrated in the residuum.

k) Paraffin content normally increases in refinery cuts and therefore pour points would also be expected to increase with cuts.

18. Do you expect petroleum cuts to show a greater or narrower range of K factor relative to whole crudes?

19. A widely accepted definition of heavy petroleum is any type of crude oil that does not flow easily. Expand upon this definition using characteristic properties of heavy oils.

20. Extra-heavy crudes often have more than 50 wt.% residues and are processed at the mine site. Why?

21. What is the primary difference between absolute and kinematic viscosity?

22. Why are two reference temperatures used when reporting viscosity?

23. Does the presence of wax and heavy compounds increase the pour point of petroleum fractions? How?

24. Why are cloud points usually not reported for light fractions such as naphtha and gasoline?

25. Cloud point of an oil is reported as $25°$ F. Estimate the likely and possible pour point range.

26. How is specific gravity and viscosity influenced by resins and asphaltenes?

27. How can asphaltenes create problems in oil production and refining?

28. How are kinematic and absolute viscosity related?

29. How are kinematic viscosity and absolute viscosity determined and relate to each other?

30. Graph the distillation curves for Basra medium (29.1°API, 3.05% sulfur) and Kirkuk (34.1°API, 2.24% sulfur) crude oil on the same plot and estimate the percent of light naphtha (15–80°C), heavy naphtha (80–160°C), kerosene (180–230°C), and gas oil (230–400°C)

fractions. If the crude oils are heated to 750°F (399°C) and charged to the distillation tower, how much of the Basra medium and Kirkuk will change to vapor? What percent of the crude will enter the tower as liquid? How much of each crude oil is left as residue?

Temperature °C	Basra medium (vol%)	Kirkuk (vol%)
80	8	14
90	9.24	16.99
100	10.59	20.37
120	13.59	25.83
140	16.79	29.49
160	19.96	33.57
180	22.95	37.99
200	25.76	42.47
220	28.44	46.99
240	30.89	51.92
260	32.98	57.66
280	34.82	64.25
300	37.22	71.04
320	40.74	76.62
340	44.27	80.42
360	47.27	83.4
380	49.95	86.34
400	52.58	89.37
420	55.28	92.37
440	58.07	95.04
460	60.92	96.97
480	63.8	98.02
500	66.67	98.47
520	69.51	98.67
540	72.26	98.81
560	74.92	98.93
580	77.46	99.05

31.   Graph the distillation curve for Basra heavy (23.7° API, 4.12% sulfur) and Taq-Taq (46.3° API, 0.65% sulfur) crude oil on the same plot and estimate the percent of light naphtha (15–80° C), heavy

naphtha (80–160° C), kerosene (180–230° C), and gas oil (230–400 $^\circ$ C) fractions. If the crude oils are heated to 750° F (399° C) and charged to the distillation tower, how much of the Basra heavy and Taq-Taq will change to vapor? What percent of the crude will enter the tower as liquid? How much of each crude oil is left as residue?

Temperature °C	Basra heavy (vol%)	Taq-Taq (vol%)
80	2.87	12.6
100	4.52	18.58
120	6.56	23.46
140	8.78	28.91
160	10.86	34.2
180	13.12	39.75
210	16.37	46.38
230	18.89	51.14
250	21.75	55.66
270	24.93	60.12
290	27.9	64.08
320	33.69	69.27
350	38.01	74.13
370	41.12	77.84
400	45.81	81.64
530	63.52	91.59
550	66.5	93.45