FLUID PRESSURE EXERCISE

This exercises uses data from the Elysian Field.

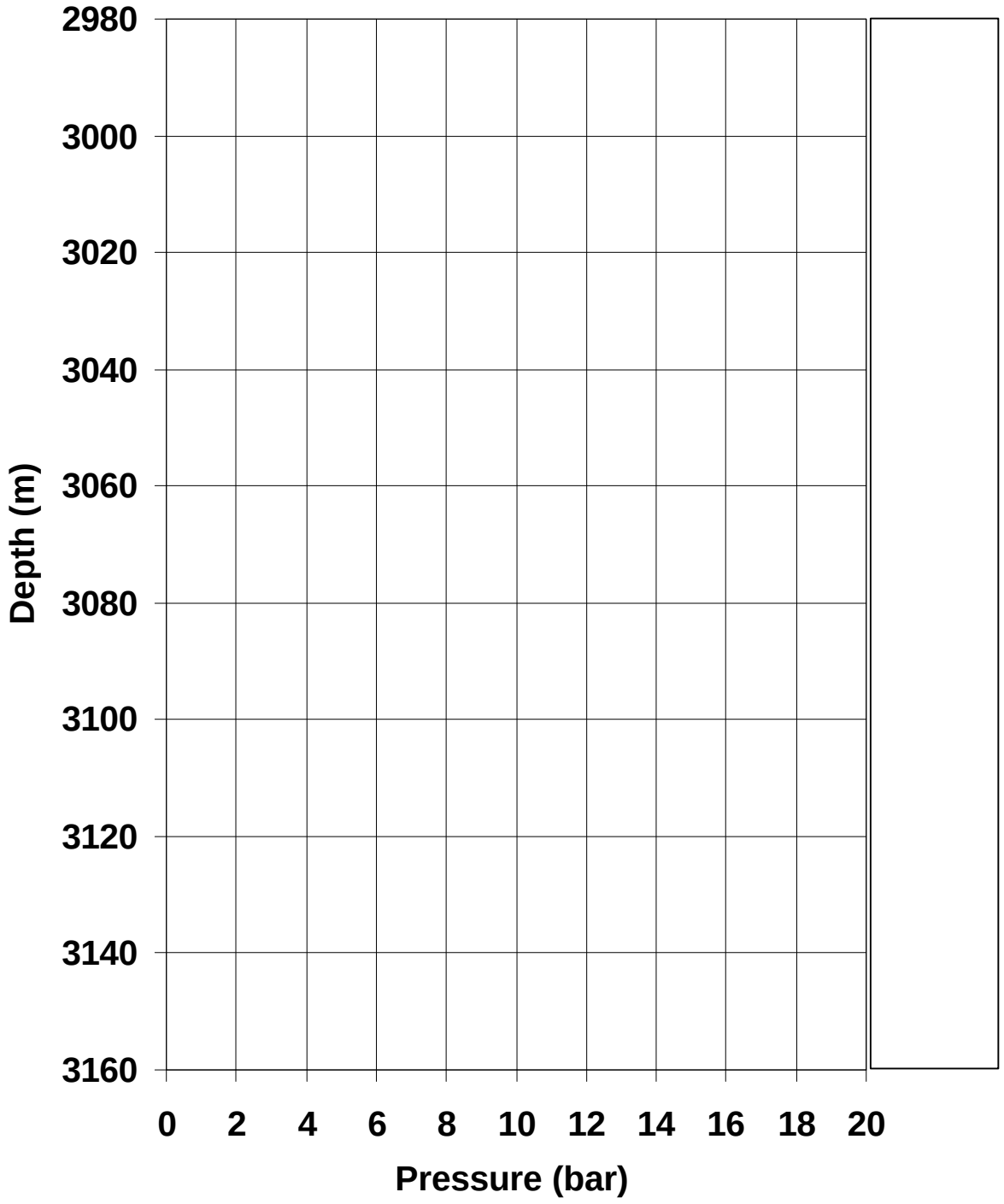
Well: 24-1X
Depth Range: 2980 – 3160 m
Lithology: Variable

An RFT log has been run in the reservoir section of well 24-1X of the Elysian Field between depths of 2990 m and 3145 m.

The following data were collected:

Depth (m)	Lithology	Fluid	Fluid Pressure (bar)	Water-Oil Capillary Pressure (psi)	Gas-Oil Capillary Pressure (psi)
2980-2985	*Shale*	*No sample*	*No measurement*		
2990	Sandstone	Gas	7.2981		
2995	Sandstone	Gas	7.2986		
3000	Sandstone	Gas	7.2991		
3005	Sandstone	Gas	7.2996		
3015	Sandstone	Oil	7.6501		
3020	Sandstone	Oil	8.0001		
3025	Sandstone	Oil	8.3501		
3028	Sandstone	Oil	8.5601		
3035-3075	*Clean sandstone at 3075 m fining up gradually until a shale is reached at 3035 m*	*No sample*	*No measurement*		
3082	Sandstone	Oil	12.3401		
3085	Sandstone	Oil	12.5501		
3090	Sandstone	Oil	12.9001		
3095	Sandstone	Oil	13.2501		
3100	Sandstone	Oil	13.6001		
3105	Sandstone	Oil	13.9501		
3110	Sandstone	Oil	14.3001		
3125	Sandstone	Water	15.5000		
3130	Sandstone	Water	16.0000		
3135	Sandstone	Water	16.5000		
3140	Sandstone	Water	17.0000		
3145	Sandstone	Water	17.5000		
3150-3160	*Shale*	*No sample*	*No measurement*		

(a) Draw a graph of depth (y-axis, linear, 2980 to 3160 m increasing downwards) against fluid pressure (x-axis, linear, 0 to 20 bar).



(b) Shade the column to the right of the plot with the appropriate lithology.

(c) Mark on the graph and measure the depth of (i) the free water level (*FWL*), (ii) the likely gas-oil contact (*GOC*).

(d) The graph also indicates a possible gas-water contact (*GWC*). Mark it on the graph. Why does this not exist in reality?

(e) Is the gas and oil in the sandstone formation between 2990 and 3028 m in communication with the oil and water in the sandstone formation between 3082 and 3145 m? Why do you reach this conclusion? What inference can you make about the composition of the oil in each formation?

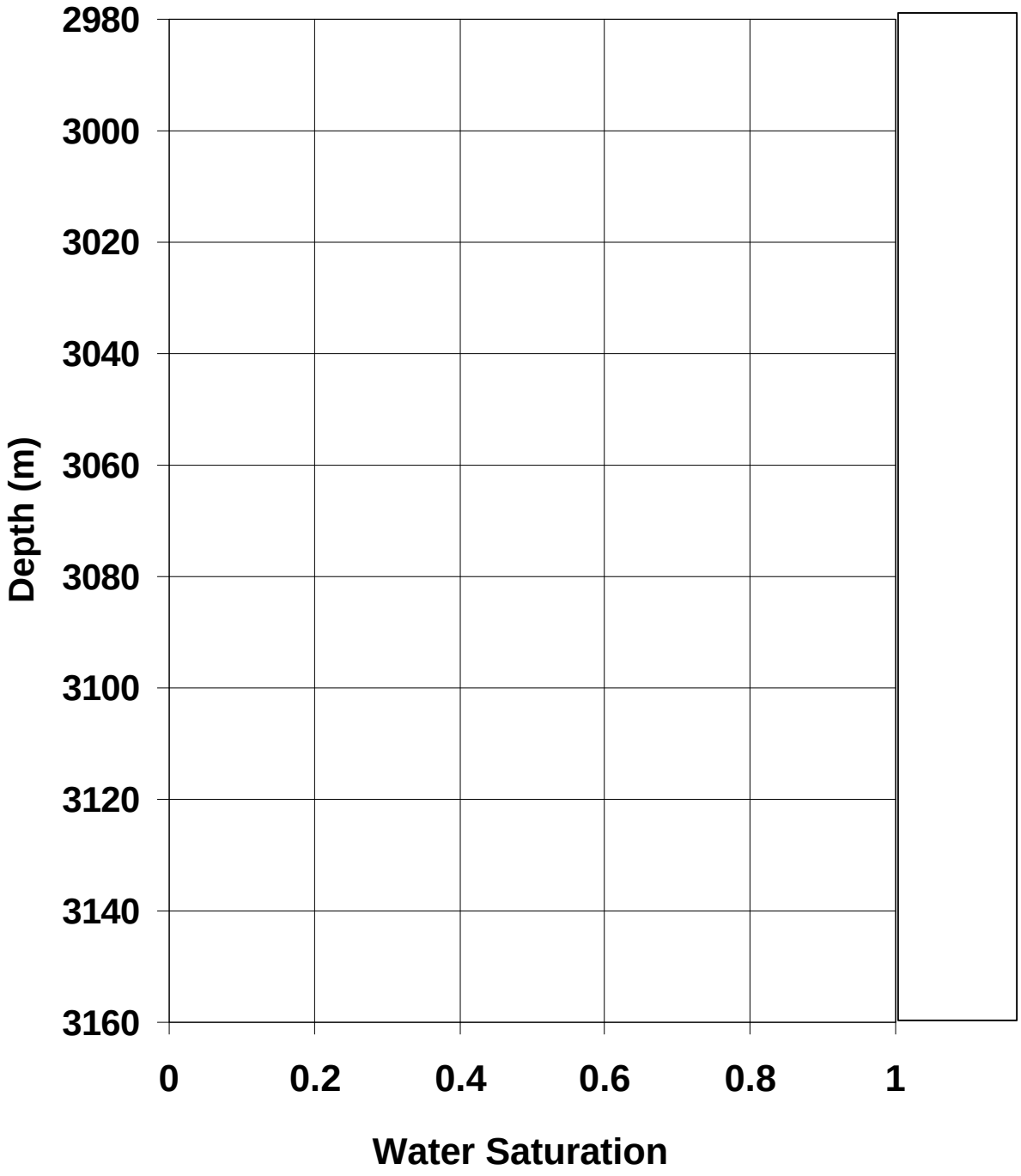
(f) Calculate the density of each of the fluids (gas, oil and water) in g/cm^3 using the gradients of the fluid lines. Note that to convert bars to pascals (Pa) multiply the value in bars by 10^5. Note also that the acceleration due to gravity, $g = 9.81\ ms^{-2}$.

(g) Calculate the gradient of the gas, water and oil lines in psi/m (1 bar/m = 14.50 psi/m).

(h) Calculate the water-oil and gas-oil capillary pressures in psi, and insert the results into the table.

(i) Obtain the water saturation at each depth in the interval 3015 – 3145 m, and plot it on a graph of depth (y-axis, linear 2980 – 3160 m increasing downwards) against water saturation (x-axis, linear 0.0 to 1.0).

(j) Comment upon the relative reliability of this water saturation curve in the depth intervals 3015 m to 3035 m, 3035 m to 3082 m, 3082 m to 3145 m. If the curve is unreliable in any of these intervals indicate whether the water saturation is under- or over-estimated and by approximately how much. How does the fining-up sequence influence the water saturation?


2980
3000
3020
3040
3060
3080
3100
3120
3140
3160
Depth (m)
0
0.2
0.4
0.6
0.8
1
Water Saturation