3–21 Complete this table for H_2O:

	T, °C	P, kPa	u, kJ/kg	Phase description
①	143.61°C	400	1450	Sat. liq. vap. mix.
②	220			Saturated vapor
③	190	2500		
④		4000	3040	

Part ①

Go to Table A-5, and check u_f & u_g at 400 kPa

$u_f = 604.22$ kJ/kg, $u_g = 2553.1$ kJ/kg

Since u given is $> u_f$ and $< u_g$

$u_f < u < u_g \rightarrow$ saturated liquid vapor mixture

Since the water is saturated, $T = T_{sat}$

→ Go to Table A-5 and find T_{sat} at 400 kPa → $T_{sat} = 143.61°C$

$$x = \frac{u - u_f}{u_{fg}} = \frac{1450 - 604.22}{1948.9} =$$

3–21 Complete this table for H_2O:

	T, °C	P, kPa	u, kJ/kg	Phase description
①	143.61°C	400	1450	Sat. liq.-vap. mix.
②	220	2319.6	2601.3	Saturated vapor
③	190	2500		
④		4000	3040	

Part ②

Since the water is saturated vapor,

$u = u_g$ and $P = P_{sat}$

Go to Table A-4 and find u_g and P_{sat} at 220°C:

$u_g = 2601.3$ kJ/kg

$P_{sat} = 2319.6$ kPa

Since the water is saturated vapor, the quality is automatically = 1

3–21 Complete this table for H_2O:

	T, °C	P, kPa	u, kJ/kg	Phase description
①	143.61°C	400	1450	Sat. liq.vap. mix.
②	220	2319.6	2601.3	Saturated vapor
③	190	2500	806	comp. liq.
④		4000	3040	

Part (3)

We need to identify the phase:

Go to Table A-5 and find T_{sat} at 2500 kPa

$T_{sat} = 223.95°C$

$T < T_{sat} \longrightarrow$ compressed liquid

$T \uparrow$ 190°C

Go to Table A-7 to find u at $P = 2500$ kPa

$P = 2500$ kPa is not available in Table A-7

In this case, we need to use the approximation

$u \simeq u_{f\,@\,190°C} \longrightarrow$ Go to Table A-4

$u \simeq 806$ kJ/kg

3–21 Complete this table for H_2O:

	T, °C	P, kPa	u, kJ/kg	Phase description
①	143.61°C	400	1450	Sat. liq.-vap. mix.
②	220	2319.6	2601.3	Saturated vapor
③	190	2500		
④		4000	3040	Superheated vapor

Part (4)

Go to Table A-5 and find u_f & u_g at 4000 kPa:

$u_f = 1082.4$ kJ/kg , $u_g = 2601.7$ kJ/kg

Since $u > u_g$ → superheated vapor

Go to Table A-6, and find $u = 3040 \frac{kJ}{kg}$

This value is not available

→ we need to interpolate

T	u
450 ←	3011
T ←	3040
500 ←	3100.3

$$\frac{T - 450}{500 - 450} = \frac{3040 - 3011}{3100.3 - 3011}$$

$T =$