

**Self-Assessment Before and After Facilitating Session.Topic:  
Pure Substance – Part 1**

Facilitators's Name: \_\_\_\_\_

Your Name: \_\_\_\_\_

**Name:** \_\_\_\_\_

Self Assessment - Preparatory

Please use the following codes and please mark your selection. <b>1= Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree</b>		Before peer teaching					After peer teaching								
		SD				SA					SD				SA
1.	I have read the chapter before coming to the discussion session today.	1	2	3	4	5					1	2	3	4	5
2.	I am positive that the study of thermodynamics involved interaction of energies with a system and I need to know both the language that is used and the rules governing the interaction and the physically measurable changes that happened to the system.	1	2	3	4	5					1	2	3	4	5
3.	I am able to state that a <u>system</u> is simply a space or mass that I choose to study. As an example, the air in a room, coffee in a mug, petrol in piston-cylinder device can be systems that I choose to look at.	1	2	3	4	5					1	2	3	4	5
4.	I am aware that a <u>property is just a set of characteristics of the system</u> . The properties include temperature, T, pressure, P, density (the amount of mass contained in a 1 m <sup>3</sup> volume), ρ, volume, V, the internal energies, U, the kinetic energies, KE, the potential energies, PE, the total energy, E and many more.	1	2	3	4	5					1	2	3	4	5
5.	I know that a <u>process in thermodynamics is a change in the system's equilibrium state</u> .	1	2	3	4	5					1	2	3	4	5
6.	I know that an <u>equilibrium state</u> is a state when all the system's properties remain constant in time and in space.	1	2	3	4	5					1	2	3	4	5
7.	I am aware that a process has taken place whenever there are changes in the system's properties such as changes in T, P, E, V or the mass, m. In thermodynamics, we are interested in the amount of change in a system's properties.	1	2	3	4	5					1	2	3	4	5
8.	I realize that in thermodynamics I need to specify at least <u>2 independent and intensive properties to specify the state of the system at any time (state postulate)</u> . Changes in the states are physically identified by the change in its intensive properties.	1	2	3	4	5					1	2	3	4	5
9.	I know that independent means that a change in one property will not affect the other property while intensive implies properties that do not depend on the size of the system.	1	2	3	4	5					1	2	3	4	5
10.	I realize that intensive properties can be easily obtained by considering the system to have a mass of 1 kg. Hence, to obtain an intensive property, I will just divide all of the size-dependent extensive properties by the mass of the system. Examples are the specific internal energy, $u = U/m$ , the specific total energy, $e = E/m$ , the specific volume, $v = V/m$ , the specific kinetic energy, $ke = KE/m$ , the specific potential energy, $pe = PE/m$ , and many more. <i>Notice that the intensive properties are represented by using lower case alphabets and the term "specific" is used to mean "for a unit mass or for 1 kg of the system".</i>	1	2	3	4	5					1	2	3	4	5
11.	I also realize that upper case alphabets are used to represent extensive properties, properties that depend on the size of the system. Hence, the larger the mass of the system, the larger the value for the extensive properties.	1	2	3	4	5					1	2	3	4	5
12.	I can give examples for specifying a state of a system involving independent intensive properties such as: (P,T); (P, u); (T,u); (P, v); and (T, v).	1	2	3	4	5					1	2	3	4	5

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13.	I am aware that the common system involved in thermodynamics are the pure substances; substances that have homogeneous chemical composition throughout. Examples include water, refrigerants used for cooling, nitrogen, helium, air in gaseous phase, a two-phase such as ice-water mixture and water-vapor mixture. Oil-water mixture is not a pure substance since the two substances do not mix homogeneously.	1	2	3	4	5								
14.	I know that water is the most common pure substance used in thermodynamics applications such as the power plants in the production of electricity.	1	2	3	4	5								
15.	I realize that water can exist in the solid phase (ice), the liquid phase and the gaseous phase (vapor).	1	2	3	4	5								
16.	I realize that the solid-liquid mixture (ice-water mixture) and the liquid-gaseous mixture (water-vapor mixture) respectively can coexist in real life as exhibited by iced-tea (ice-water mixture at its melting point) that I always drink or the water that is boiling (liquid-vapor mixture at its boiling point).	1	2	3	4	5								
17.	I am aware that phase changes for water from ice (solid phase) to water (liquid phase) and to vapor (gaseous phase), can be achieved by placing ice in a flask and placing it on a stove (applying external energy) continuously.	1	2	3	4	5								
18.	I can sketch a temperature versus specific volume graph (T - v) for the phase change process of the ice that I had placed on the stove in my kitchen. Given a pressure of 101 kPa or atmospheric pressure, water begins to melt (ice changing to liquid) at 0°C and begins to boil (liquid begin to vaporize) at 100°C. The boiling temperature is known as the <u>saturation (boiling) temperature at 101 kPa</u> and is normally represented by <b>T = T<sub>sat@101kPa</sub></b> .	1	2	3	4	5								
19.	I know that the state at the start of boiling (phase change) is called the <u>saturated liquid (liquid ready to vaporize)</u> phase. The state at the end of boiling is called the <u>saturated vapor (vapor ready to condense)</u> phase and in between the two states where liquid and vapor coexist, it is called the <u>saturated liquid-vapor mixture or simply wet-mix phase</u> . The state where the temperature is below the boiling point is known as <u>compressed liquid (liquid not ready to vaporize)</u> phase while the state where the temperature is higher than the boiling point is referred to as <u>superheated vapor phase (vapor not ready to condense)</u> .	1	2	3	4	5								
20.	I realize that the T - v diagram will look almost the same in form but will have a higher saturation (boiling) temperature for a higher pressure and a lower saturation temperature for a lower pressure.	1	2	3	4	5								
21.	I am aware that the specific volume at the start of boiling (liquid starts to vaporize) <i>increases with an increase in pressure</i> while the specific volume at <i>the end of boiling (all the liquid turns into vapor) decreases with an increase in pressure</i> . The subscript <i>f</i> and subscript <i>g</i> is used to designate properties at the saturated liquid state and the saturated vapor respectively. For example, <i>v<sub>f</sub></i> and <i>v<sub>g</sub></i> are the specific volume for the saturated liquid and saturated vapor respectively. Note that the phase change occur at the constant boiling (saturation) temperature. These values can be found in a <u>property table</u> such as given in Appendix A-5 in my Thermodynamics textbook.	1	2	3	4	5								
22.	I realize that as the pressure increases, the horizontal line connecting the saturated liquid and saturated vapor points gets shorter and eventually vanishes. The point where the line vanishes and the saturated liquid and saturated vapor point merges is called the <u>critical point</u> . This point has a pressure of P <sub>cr</sub> = 22.09 MPa (1MPa =	1	2	3	4	5								

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23.	1000 kPa), a temperature of $T_{cr} = 374.14^{\circ}\text{C}$ , and a specific volume of $v_{cr} = 0.003155 \text{ m}^3/\text{kg}$ . Beyond this point there is no wet-mix phase, only the superheated vapor phase. I realize that by drawing a line to connect the saturated liquid points and a line to connect the saturated vapor points through the critical point, for pressure lines at and below the critical pressure, I will see a dome being formed. States to the left of the saturated liquid line but below the critical temperature is compressed liquid, those within the line (underneath the dome) is wet-mix and the phase to the right of the saturated vapor line and also above the critical temperature is the superheated vapor phase. The $T - v$ diagram containing the saturated liquid and saturated vapor lines and the pressure lines is known as a property diagram.	1	2	3	4	5	1	2	3	4	5
24.	I know that values for the saturation temperatures, saturated liquid volume, $v_f$ and saturated vapor volume, $v_g$ for any pure substances at any given pressure can be obtained from tables such as table A1 through A13 in the Yunus & Cengel Thermodynamics textbook.	1	2	3	4	5	1	2	3	4	5
25.	Using table A-5 (saturated water-pressure table), for example, I found that water at a pressure of $P = 50 \text{ kPa}$ starts to boil at $81.33^{\circ}\text{C}$ ( $T_{sat@50 \text{ kPa}} = 81.33^{\circ}\text{C}$ ). The volume for the saturated liquid state is $v_f = 0.001030 \text{ m}^3/\text{kg}$ and the volume when all the water has turned into vapor (saturated vapor phase) is $v_g = 3.240 \text{ m}^3/\text{kg}$ . Hence, if I had 1 kg of water at a temperature of $25^{\circ}\text{C}$ , the water is in <u>compressed liquid phase</u> (since the given temperature, $T < T_{sat@50 \text{ kPa}}$ ) which means that <b>its volume can be estimated to be <math>n = n_f@25^{\circ}\text{C}</math> (read the temperature table A-4, <math>n_f@25^{\circ}\text{C}</math>)</b> . It will start boiling if I can increase the temperature to the saturation temperature, $81.33^{\circ}\text{C}$ . At this temperature, further addition of energy will force the water to begin vaporizing. The energy required to change 1 kg of water at its boiling point completely into vapor is called <u>specific latent heat of vaporization</u> . On the contrary, if the water temperature is given as $100^{\circ}\text{C}$ , then the water is <u>superheated vapor because this temperature is bigger than the saturation (boiling) temperature</u> at 50 kPa ( $T > T_{sat@50 \text{ kPa}}$ ). If this was the case, then the other properties for water at the given $T$ and $P$ , can be obtained by reading table A-6 (superheated water table).	1	2	3	4	5	1	2	3	4	5
26.	I am able to read the table in the textbook such as table A-5 to determine the saturation temperatures, $T_{sat@P}$ , the saturated liquid volume, $v_f$ , the saturated vapor volume, $v_g$ and the volume, $v$ , (superheated vapor or compressed liquid phase) values for any given pressures. In addition, I can determine the phase of the system once I have 2 independent intensive properties (such as $T, v$ , or $T, P$ ) and to mark the phase of the system on a $T - v$ diagram with respect to the saturation lines (the dome) that I have sketched.	1	2	3	4	5	1	2	3	4	5
27.	I am aware that the symbol $h$ in the table designates <u>specific enthalpy</u> (enthalpy present for 1 kg of the system), a form of energy. Enthalpy, $H$ , is sum of both the system's internal energy $U$ and, $PV$ , a form of energy due to work done on or by the system. Mathematically, I can represent the enthalpy as, <b><math>H = U + PV</math> in kJ or alternatively, <math>h = u + Pn</math> in units of kJ/kg.</b>	1	2	3	4	5	1	2	3	4	5