

Your Number _____

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Practice Problems for Test 1
Fall 2015

PETROLEUM ENGINEERING 310

Ground Rules

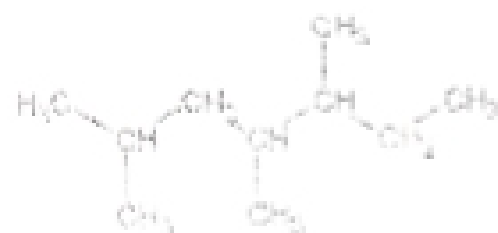
Allowed:

Forbidden:

Only interpretation questions are allowed, stand up and/or wave your hands and the TA's or myself will assist you.

NOTE: The real exam will be shorter than this, but this is a good representation of the type of problems you may have.

1. Name the following chemicals using the IUPAC rules (other molecules with the same level of complexity may be included)



2,4,5-trimethyl heptane



1,4-dimethyl benzene



propene



2-methyl pentane

2. Draw the structural formula for 3-methyl decane (or others)



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3. Indicate what is wrong with the following formula... (check for consistency) ... think about ρ

4. Provide an example of an intensive property and one example of a system.

intensive property: density

system: fish bowl

If half of the water is removed from the bowl, the density of the water removed and still in the bowl are the same as before the water was removed

5. A gas mixture is made with 5 moles of methane, 5 moles of ethane, and 5 moles of CO₂. Find the molar mass, weight, mole fraction, and the weight fraction of each component in the mixture.
Additional information: The atomic weight of carbon is 12 g/mole and of hydrogen, 1 g/mole.

Write your response in the table provided below

Component	Molecular Weight (g/mole)	Mass (g)	moles (mole)	Mole Fraction	Weight Fraction
Methane CH ₄	16	80	5	0.33	33.3%
Ethane C ₂ H ₆	30	150	5	0.33	45.5%
CO ₂	44	220	5	0.33	61.2%
	90	335	15	100%	100%

6. If the weight fraction of a 100.00 g mixture of methane and ethane is 0.33, what's the mole fraction of methane?

methane = 16 g/mole ethane = 30 g/mole

$$56 = 57 = \frac{M_{\text{me}}}{M_{\text{av}}} = \frac{M_{\text{me}}}{28.97 \text{ g/mole}} \rightarrow M_{\text{me}} = 16.5129 \text{ g/mole}$$

$$x(16) + y(30) = 16.5129$$

$$x + y = 1$$

ethane = 16.3%

$$y = 3.66\%$$

$$16(1-x) + 30x = 16.5129$$

$$16 - 16x + 30x = 16.5129$$

7. The following a series of true or false statements about the water phase diagram is correct. You may also have a mix and match several statements like the quiz in class.

Statements	True	False
Water density at 0°C is 999.84 kg/m ³	<input checked="" type="checkbox"/>	<input type="checkbox"/>
At a pressure of 101325 Pa, the condensation temperature of pure water is 100°C	<input type="checkbox"/>	<input checked="" type="checkbox"/>
At 0°C, the triple point of water is 0.01°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The boiling value of a gas always increases with the critical pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The critical point of a mixture is the highest temperature and pressure at which the phase of the mixture is liquid	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pressure of the phase of H ₂ O is 101325 Pa	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Sulfur compounds in oil (petroleum) poisons catalysts in refining	X	
Composition is an example of an extensive property		X
To define the state of a ternary mixture you need to provide: pressure, temperature, and the mass fraction of the lighter component		X
Calcium Chloride is a good example of a covalent bond		X
The benzene molecule has three double bonds		X
A reservoir producing a dry gas cannot produce water		X
The methane composition of a two component mixture existing in two phases is: 0.3 for the gas phase and 0.6 for the liquid phase		X

8. You decided to go camping and wanted to find out how much liquid propane is left in a used cylinder. The weight of this cylinder when it is full and empty is 30 pounds and 20 pounds respectively. Currently it weighs 50 lb. If the densities of liquid and vapor propane at 70 °F are: 30.19 lb/ft³ and 1.15 lb/ft³ respectively. Determine:

(a) Volumetric percentage of the propane liquid phase left the cylinder



60 lb_m initial
30 lb_m present

$$\frac{60 \text{ lb}_m}{30.19 \text{ lb}_m/\text{ft}^3} = 1.987 \text{ ft}^3$$

$$x + y = 1 \rightarrow 1 - x = y$$

$$x(30.19) + y(1.15) = 30 / (1.987 \text{ ft}^3)$$

$$30.19x + 1.15(1 - x) = 15.095$$

$$(29.04)x = 13.945$$

$$x = 48.0\%$$

(b) Mass fraction of liquid propane in the cylinder

(c) What's the volume of the cylinder excluding propane... Imagine that with propane is a bulk volume and without propane (which is occupying the pore space) you are evaluating the volume of the material. Assume it's made of iron (density is 491 lb/ft³)

$$b) (30.19 \text{ lb}/\text{ft}^3) \times (.48) \times (1.987 \text{ ft}^3) = 28.79 \text{ lb}_m$$

$$\frac{28.79 \text{ lb}_m}{30 \text{ lb}_m} = \boxed{96.0\%}$$

c) 20 lb container without propane

$$\frac{20 \text{ lb}}{491 \text{ lb}/\text{ft}^3} = \boxed{.0407 \text{ ft}^3}$$