King Saud University

Petroleum and Natural Gas Engineering

PGE 362: **Properies of Reservior Fluids**

Posted: **Sunday, September 21, 2014** Due: **Sunday, October 12, 2014**

Homework One (Solution)

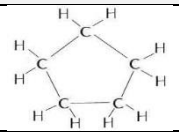
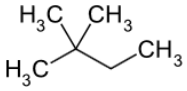
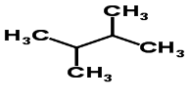
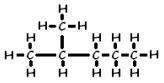
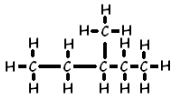
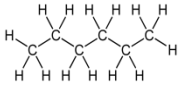
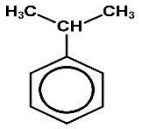
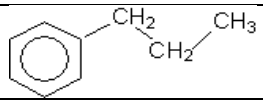
Solve the following problems from (The Properties of Petroleum Fluids, McCain) book.

1. 1-2
2. 1-5
3. 1-12
4. 1-13
5. 3-1
6. 3-2

1–2. The table below gives the hydrocarbons which have been identified in the gasoline fraction of a crude oil. Identify the paraffins, naphthenes, and aromatics and draw the molecular structure of each.

Hydrocarbon
Cyclopentane
2,2-Dimethylbutane
2,3-Dimethylbutane
2-Methylpentane
3-Methylpentane
n-Hexane
Methylcyclopentane

Solution

HC	Type	Molecular Structure
Cyclopentane	naphthene	
2,2-Dimethylbutane	paraffin	
2,3-Dimethylbutane	paraffin	
2-Methylpentane	paraffin	
3-Methylpentane	paraffin	
n-Hexane	paraffin	
Methylcyclopentane	naphthene	
Iso-propylbenzene	aromatic	
n-propylbenzene	aromatic	

1–5. Draw structural formulas for the isomers of heptane. Name the isomers by the IUPAC system.

Solution

Video

http://www.youtube.com/watch?v=AzD3lGl05fM

1–12. Predict which one of each pair below will have the higher boiling point temperature. Justify your prediction in each case.

a. 3-Methylpentane and 3-methylhexane
b. 3-Methylpentane and n-hexane
c. n-Pentane and 1-pentene
d. 1-Pentene and 2-methyl–1-butene

Solution

Boiling Point:

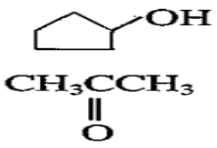
1. Increase with increasing number of carbons?
2. Decrease with chain branching?

1–13. Name the following compounds:

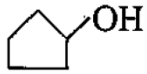
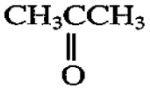
CH_3CH_2SH

$CH_3CH_2NH_2$

$CH_3CH_2CH_2CH_2COOH$



Solution

Molecular Structure	Name
CH3CH2SH	Ethanol
CH3CH2NH2	Ethylamine
CH3CH2CH2CH2COOH	Pentanoic acid
	Cyclopentanol Cyclopentyl alchohol Hydrocyclopentane
	Acetone Propanone

3–1. Calculate the molar volume of an ideal gas at 100 psia and 90°F.

Solution

$PV = n\,RT$

$(100)V = (1)(10.73)(90 + 460)$

$V = \dfrac{(1)(10.73)(90 + 460)}{(100)} = 59.015\ ft^3$

3–2. A pure gaseous hydrocarbon has a density of 0.103 lb/cu ft at 14.7 psia and 100°F. Chemical analysis shows that there are two hydrogen atoms for each carbon atom in each molecule. What is the formula of this molecule? Assume that the hydrocarbon acts **like an ideal**.

Solution

Given:

ρ = 0.103 lb.ft3

P = 14.7 psia

T = 100 °F = 100 + 460 = 560 °R

C_mH_{2m}

$PV = nRT$

$14.7\ V = \frac{wt}{MW} \times 10.73 \times 560$

$MW = \frac{wt}{V} \times 10.73 \times 560/14.7$

$MW = \rho \times 10.73 \times 560/14.7$

$MW = 0.103 \times 10.73 \times \frac{560}{14.7}$

$MW = 42$

$MW = 12m + 2m = 42$

$14m = 42$

$m = \frac{42}{14} = 3$

C_3H_6