

Homework #5

Imagine that you have been hired to work at a small refinery. You've been asked to do calculations to support the blending of several intermediate streams to get gasoline. The data for the blend stocks is in attached table.

1. You are asked to blend to the following recipe:

Blend Stock	Vol%
Light Cat Cracked Naphtha	0%
Heavy Alkylate	15%
Mid Cut Reformate	35%
Heavy Reformate	25%
C6 Isomerate	25%
n-Butane	0%

Calculate the following for this blend;

- What is the expected API gravity of the blend?
 - What are the expected RON, MON, and average octane numbers of the blend when using volumetric blending?
 - What are the expected RON, MON, and average octane numbers of the blend when using the non-linear blending rules?
 - What is the expected RVP of the blend? (Use the appropriate blending indices.)
2. How much Light Cat Cracked Naphtha can be added to the blend in #1 without exceeding the benzene limit of 0.62 vol%. What is the $(R+M)/2$ octane number as calculated from the non-linear blending rules?
 3. How much n-Butane can be added to to the blend in #1 and still make a Colorado summer blend with 9.0 psi RVP? What is the $(R+M)/2$ octane number as calculated from the non-linear blending rules?

Blending Component	Light Cat Cracked Naptha	Heavy Alkylate	Mid Cut Reformate	Heavy Reformate	C6 Isomerate	NC4
Gravity, °API	66.8	55.8	32.8	29.8	83.0	110.8
Aromatics, vol%	17.6	1.0	94.2	93.8	1.6	0
Olefins, vol%	44.9	0.9	0.6	1.9	0.1	0
Saturates, vol%	37.4	98.1	5.1	4.2	98.3	100
Benzene, vol%	1.24	0.01	0.00	0.00	0.00	0
Bromine Number	91.4	0.3	0.6	0.9	3.8	
RVP, psi	8.7	0.3	1.0	0.3	8.0	52
Distillation, °F						
IBP	95	299	224	313	118	
T05	117	318	231	326	131	
T10	124	325	231	328	134	
T20	130	332	231	331	135	
T30	139	340	232	335	135	
T40	149	345	233	339	136	
T50	164	354	234	344	136	
T60	181	362	235	350	137	
T70	200	373	237	358	137	
T80	224	391	240	370	138	
T90	257	427	251	391	139	
EP	337	517	316	485	146	
RON	93.6	65.9	109.3	104.3	78.6	93.8
MON	79.4	74.5	100.4	92.4	80.5	89.6
Carbon, wt%	85.60	84.39	90.87	89.62	83.44	
Hydrogen, wt%	14.20	15.54	9.32	10.34	16.49	
Nitrogen, ppmw	27	0	0	0	0	
Sulfur, ppmw	0	15	10	8	10	