Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

<table>
<thead>
<tr>
<th>Blend vol%</th>
<th>Light Straight Run Naptha</th>
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<td>Blend vol%</td>
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<td>Gravity, °API</td>
<td>81.8</td>
<td>32.8</td>
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<td>Specific Gravity</td>
<td>0.6634</td>
<td>0.8612</td>
<td></td>
<td></td>
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<tr>
<td>Aromatics, vol%</td>
<td>2.2</td>
<td>94.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olefins, vol%</td>
<td>0.9</td>
<td>0.6</td>
<td></td>
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<tr>
<td>RVP, psi</td>
<td>10.8</td>
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<td>RON</td>
<td>63.7</td>
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<td>(R+M)/2</td>
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<td>J = R-M</td>
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What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

Since these values are volume%, they can be directly calculated as volume averages.

\[
\bar{A} = (0.33)(2.2) + (0.67)(94.2) = 63.8
\]

\[
\bar{O} = (0.33)(0.9) + (0.67)(0.6) = 0.7
\]
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

API gravity cannot be directly calculated as a volume average, but specific gravity can.

\[
\gamma_o = (0.33)(0.6634) + (0.67)(0.8612) \\
= 0.7958 \\
G = \frac{141.5}{0.7958} - 131.5 \\
= 46.3
\]
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

RVP cannot be directly calculated as a volume average. Volume average the RVP\(^{1.25}\) terms

\[
\begin{align*}
(RVP)^{\frac{1}{1.25}} &= (0.33)(10.8)^{1.25} + (0.67)(1.0)^{1.25} \\
&= 7.13 \\
(RVP) &= (7.13)^{\frac{1}{1.25}} = 4.81
\end{align*}
\]

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Updated: July 5, 2017
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Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

The simple volume average indicates a gasoline that could meet Regular gasoline octane specs.

\[
\overline{R} = (0.33)(63.7) + (0.67)(109.7)
\]
\[
= 94.3
\]

\[
\overline{M} = (0.33)(61.2) + (0.67)(100.4)
\]
\[
= 87.5
\]
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

The Ethyl model takes into account the aromatics & olefin contents of the blend stocks.

$$\bar{A^2} = (0.33)(2.2)^2 + (0.67)(94.2)^2$$

$$= 5,947$$

$$\bar{A^2} - \bar{A}^2 = 5,947 - (63.8)^2$$

$$= 1871$$
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

The Ethyl model takes into account the aromatics & olefin contents of the blend stocks.

\[
\overline{(O^2)} = (0.33)(0.9)^2 + (0.67)(0.6)^2
\]

\[
= 0.509
\]

\[
\overline{(O^2)} - \overline{O^2} = 0.509 - (0.7)^2
\]

\[
= 0.020
\]
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

The Ethyl model takes into account the spread between the Research & Motor octane numbers.

\[
\overline{J} = (0.33)(2.5) + (0.67)(8.9) \\
= 6.79 \\
\overline{RJ} = (0.33)(63.7)(2.5) + (0.67)(109.3)(8.9) \\
= 704.3 \\
\overline{RJ} - \overline{R} \cdot \overline{J} = 704.3 - (94.3)(6.79) = 64.5 \\
\overline{MJ} = (0.33)(61.2)(2.5) + (0.67)(100.4)(8.9) \\
= 649.2 \\
\overline{MJ} - \overline{M} \cdot \overline{J} = 649.2 - (87.5)(6.79) = 55.5
\]
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

Using the Ethyl model based on 135 blends...

\[
R = 94.25 + (0.03324)(64.5) + (0.00085)(0.020) = 96.4 \\
M = 87.5 + (0.04285)(55.5) + (0.00066)(0.020) - (0.00632)\left(\frac{1871}{100}\right)^2 = 87.6
\]

\[J = R - M = 2.5\]
Gasoline Blending Sample Problem

What are the API gravity, RVP, & average octane number for a 33/67 blend of Light Straight Run Gasoline & Mid-Cut Reformate?

![Table showing gasoline properties with a box highlighting the likely Premium octane specs.]

This model shows that it is likely that the gasoline will meet Premium octane specs.
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