Practice Exam A

This is the first of six practice exams. These exam questions have been taken from actual past BIS105 exams. The numbers in parentheses indicate the points for these questions (out of 100 points for the whole exam). Thus these questions represented approximately 1/6 the value of the exam. IF this is a reasonable estimate of the difficulty of these questions, you should be able to answer them in 16/100 * 50 = 8 minutes

1. (8) The standard state $\Delta G^{o'}$ for hydrolysis of glucose-1-P, 
(glucose-1-P + H$_2$O $\rightarrow$ glucose + Pi) 
is -21 kJ/mol. Calculate $\Delta G$ in kJ/mol for the hydrolysis reaction in 2 mM glucose-1-P, 2 mM glucose, and 5 mM Pi. Assume 25°C; R = 8.315 J/oK-mol

$\Delta G' = \Delta G^{o'} + RT \ln \frac{[\text{glucose}][P]}{[\text{glucose-P}]}$
$\Delta G' = -21,000 + (8.315)(298) \ln (0.002)(0.005)/(0.002) = -34,128$ J/mol

2. (8) Given 0.1 M solutions of lactic acid (CH$_3$CHOHCOOH) and Na lactate (CH$_3$CHOHCOO$^-$/Na$^+$) and the pKa = 3.86, describe the preparation of 1 liter of buffer at pH 4.5.

By Henderson-Hasselbach, 
$pH = pK_a + \log \frac{[\text{lactate}^-]/[\text{Hlactate}]}{[\text{Hlactate}]}$; $4.5 = 3.86 + \log[\text{lactate}^-]/[\text{Hlactate}]$ 
$[\text{lactate}^-]/[\text{Hlactate}] = \exp(4.5 - 3.86) = \exp(0.64) = 4.36$ 
$[\text{lactate}^-] = 4.36 \times [\text{Hlactate}]$, ml of lactate$^- = 4.36$ times the ml of Hlactate

If ml of Hlactate = $x$, $x + 4.36x = 1000$; $x = 186.6$ ml 
Add 186.6 ml of 0.1 M Hlactate to 813.4 ml of 0.1 M Na lactate
Practice Exam B

This is the second of six practice exams. These exam questions have been taken from actual past BIS105 exams. The numbers in parentheses indicate the points for these questions (out of 100 points for the whole exam). Thus these questions represented approximately 1/4 the value of the exam. IF this is a reasonable estimate of the difficulty of these questions, you should be able to answer them in $24/100 \times 50 = 12$ minutes

1. (12) Draw the chemical structure of the tripeptide, N-valine-histidine-glycine-C.

2. (12) Provide a reasonable titration curve for the tripeptide described in question 1. Assume a solution of 0.2 mmol, and starting with the most acid form, estimate the pH for the inflection points and the amounts of base needed to give the midpoint of each inflection point. (Note the pKa values below.)

<table>
<thead>
<tr>
<th>Amino acid</th>
<th>$\alpha$-COOH pKa</th>
<th>$\alpha$-$\text{NH}_3^+$ pKa</th>
<th>R group pKa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histidine</td>
<td>1.8</td>
<td>9.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Lysine</td>
<td>2.2</td>
<td>9.0</td>
<td>10.5</td>
</tr>
<tr>
<td>Valine</td>
<td>2.3</td>
<td>9.6</td>
<td></td>
</tr>
</tbody>
</table>