Lab report from the practical lesson on biochemistry

Topic: Calcium, phosphorus, sodium, metabolism of bone tissue

Task 1: Estimation of total calcium in serum and urine

Principle:

<table>
<thead>
<tr>
<th></th>
<th>Serum sample (Tube No. 1)</th>
<th>Urine sample (Tube No. 2)</th>
<th>Standard (Tube No. 3)</th>
<th>Blank (Tube No. 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 650 nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations:

Concentration of total calcium in the serum (S-Ca):

\[
S\text{-Calcium (mmol/l)} = \frac{A_{\text{serum}}}{A_{\text{standard}}} \times c_{\text{standard}}
\]

\[
\cdots \cdots \cdots \times \cdots \cdots = \cdots \cdots \cdots
\]

Concentration of calcium in the urine (U-Calcium):

\[
U\text{-Calcium (mmol/l)} = \frac{A_{\text{urine}}}{A_{\text{standard}}} \times c_{\text{standard}} \times \text{Dilution of urine}
\]

\[
\cdots \cdots \cdots \times \cdots \cdots \times \cdots \cdots = \cdots \cdots \cdots
\]
Daily output of calcium into urine (dU-Calcium):

\[
dU\text{-Calcium (mmol/24 hrs)} = \text{U-Calcium (mmol/l)} \times \text{Volume of urine (liters/24 hrs)}
\]

dU-Calcium (mmol/24 hrs) = ……………. × ……………. = ……………….

Conclusion:

Task 2: Estimation of inorganic phosphate in serum and urine

Principle:

Results:

<table>
<thead>
<tr>
<th></th>
<th>Serum sample (Tube No. 1)</th>
<th>Urine sample (Tube No. 2)</th>
<th>Standard (Tube No. 3)</th>
<th>Blank (Tube No. 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 340 nm</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Calculations:

Concentration of inorganic phosphate in serum (fS-P inorg.):

\[
fS\text{-Inorganic phosphate (mmol/l)} = \frac{A_{\text{serum}}}{A_{\text{standard}}} \times c_{\text{standard}}
\]

fS-Inorganic phosphate (mmol/l) = ……………. × ………. =…………………

………
Concentration of inorganic phosphate in urine (U-P inorg.):

\[ U\text{- Inorganic phosphate (mmol/l)} = \frac{A_{\text{urine}}}{A_{\text{standard}}} \times c_{\text{standard}} \times \text{Dilution of urine} \]

\[
\text{...........} \times \text{........} \times \text{........} = \text{..................}
\]

Daily output of inorganic phosphate into urine (dU-P):

\[ dU\text{-Inorg. phosphate (mmol/24 hrs)} = U\text{-Inorg. phosphate (mmol/l)} \times \text{Volume of urine (liters/24 hrs)} \]

\[
\text{dU-Inorg. phosphate (mmol/24 hrs)} = \text{.............} \times \text{...............} = \text{...............}
\]

Conclusion:

Task 3: Estimation of catalytic concentration of alkaline phosphatase and its isoforms
Principle:
Results:

<table>
<thead>
<tr>
<th></th>
<th>Native sample (S1)</th>
<th>Control for native sample (S2)</th>
<th>Heat-inactivated sample (T1)</th>
<th>Control for heat-inactivated sample (T2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 420 nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations:

**Subtraction of control absorbances:**

\[ \Delta A_S = A_{S1} - A_{S2} \]

\[ \Delta A_S = \text{........... - ...........} = \text{..............} \]

\[ \Delta A_T = A_{T1} - A_{T2} \]

\[ \Delta A_T = \text{........... - ...........} = \text{..............} \]

**Total catalytic concentration of ALP:**

Total ALP (μkat/l) = \( \Delta A_S \times 10.263 = \text{...........} \times 10.263 = \text{................} \)

**Catalytic concentration of the liver isoenzyme:**

Liver isoenzyme ALP (μkat/l) = 1.5 × \( \Delta A_T \times 10.263 \) = \text{.................} \)

**Catalytic concentration of the bone isoenzyme:**

Bone isoenzyme ALP (μkat/l) = Total ALP (μkat/l) − Liver isoenzyme ALP (μkat/l)

Bone isoenzyme ALP (μkat/l) = \text{............................} - \text{..........................} = \text{...........................} \)

Conclusion:
Task 4  Solubility of various calcium salts

Principle:

A. Solubility of calcium salts in water and HCl

Results:

<table>
<thead>
<tr>
<th></th>
<th>Tube No. 1 CaCl₂</th>
<th>Tube No. 2 CaCO₃</th>
<th>Tube No. 3 Ca₃(PO₄)₂</th>
<th>Tube No. 4 Ca₃(PO₄)₂ + Na₂EDTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solubility in water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solubility in HCl</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solubility in NaHCO₃</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

B. Influence of some food components on solubility of calcium salts

Results:

<table>
<thead>
<tr>
<th></th>
<th>Tube No. 1</th>
<th>Tube No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaCl₂</td>
<td>1 measure</td>
<td>1 measure</td>
</tr>
<tr>
<td>Deionized water</td>
<td>1 ml</td>
<td>1 ml</td>
</tr>
<tr>
<td>Ammonium oxalate</td>
<td>cca 5 drops</td>
<td>-</td>
</tr>
<tr>
<td>Lactose</td>
<td>-</td>
<td>cca 5 drops</td>
</tr>
</tbody>
</table>

Result

Conclusion:
Task 5  Quantitative estimation of Na\(^+\) in urine

Principle:

Results:

<table>
<thead>
<tr>
<th></th>
<th>E (mV)</th>
<th>pNa</th>
<th>Concentration Na(^+) (mol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard solution 1</td>
<td></td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Standard solution 2</td>
<td></td>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
<td>Standard solution 3</td>
<td></td>
<td>3</td>
<td>0.001</td>
</tr>
<tr>
<td>Urine sample</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calibration curve for estimation of Na\(^+\) concentration:

Plot the pNa values on the x axis and the potential in mV on the y axis. Next, use the calibration graph to read the pNa for the analyzed urine sample.
Calculation of urinary Na\(^+\) concentration:

\[ p_{\text{Na}} = -\log[\text{Na}^+] \]

\[ p_{\text{Na}}^{\text{diluted urine}} = \ldots \quad \quad [\text{Na}^+]^{\text{diluted urine}} = 10^{p_{\text{Na}}} = \ldots \quad \text{mol/l} \]

\[ U\text{-Na}^+ = 10 \times [\text{Na}^+]^{\text{diluted urine}} = \ldots \quad \text{mol/l} \]

**Daily output of Na\(^+\) into urine:**

\[ dU\text{-Na}^+ = U\text{-Na}^+ (\text{mol/l}) \times \text{Vol. urine (liters/24 hrs)} \]

\[ dU\text{-Na}^+ = \ldots \times \ldots = \ldots \quad \text{mol/24 hrs} \]

**Fractional excretion (FE) of Na\(^+\):**

\[ \text{U}_\text{Cr} \quad \text{Concentration of creatinine in urine (mmol/l):} \quad \ldots \]

\[ \text{P}_\text{Cr} \quad \text{Concentration of creatinine in serum (mmol/l):} \quad \ldots \]

\[ \text{U}_\text{Na} \quad \text{Concentration of sodium in urine (mmol/l):} \quad \ldots \]

\[ \text{P}_\text{Na} \quad \text{Concentration of sodium in serum (mmol/l):} \quad \ldots \]

\[ \text{FE}_{\text{Na}} = \frac{\text{U}_\text{Na} \times \text{P}_\text{Cr}}{\text{U}_\text{Cr} \times \text{P}_\text{Na}} \]

\[ \ldots \times \ldots \quad \text{FE}_{\text{Na}} = \ldots \quad \ldots \quad \ldots \quad \ldots \]

**Tubular resorption (TR) of Na\(^+\):**

\[ \text{TR}_{\text{Na}} = 1 - \text{FE}_{\text{Na}} = \ldots \]

**Conclusion:**