I. (15 pts.) Define **five** of the following seven terms. Clearly mark the **five** to be graded.

1. Population

2. Precision

3. Systematic Error

4. Degrees of Freedom

5. z

6. Buoyancy Error

7. Analytical Molarity
II. A. (5 pts) What is the mass in milligrams of solute in 737.0 mL of a solution that contains 6.38 ppm Pb(NO$_3$)$_2$?

B. (5 pts) Calculate the analytical concentration of NO$_3^-$

C. (5 pts) What is the pNO$_3^-$?

III. (6 pts) List three types of systematic errors.

IV. (10 pts) What mass of solid Hg$_3$PO$_4$ is formed when 50.0 mL of 0.4230 M Na$_3$PO$_4$ is mixed with 100.0 mL 0.5151 M HgNO$_3$?
V. Consider the following set of data:

<table>
<thead>
<tr>
<th>Trial Number</th>
<th>Value (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24.53</td>
</tr>
<tr>
<td>2</td>
<td>24.68</td>
</tr>
<tr>
<td>3</td>
<td>24.77</td>
</tr>
<tr>
<td>4</td>
<td>24.81</td>
</tr>
<tr>
<td>5</td>
<td>24.73</td>
</tr>
</tbody>
</table>

For question 1 – 5 calculate the following. **Show all work including equations.** (4 pts each).

1. Mean

2. Median

3. Range

4. Standard Deviation

5. Relative Standard Deviation

If the accepted value is 24.75 calculate:

6. absolute error of the mean

7. Relative error of the mean
VI. (5 pts each) Estimate the absolute standard deviation and coefficient of variation for the results of the following calculation. Round results to include only significant figures. The numbers in parentheses are the standard deviations.

1. \[ Y = 90.31 (\pm 0.08) - 89.32 (\pm 0.06) + 0.200 (\pm 0.004) \]

2. \[ Y = 251 (\pm 1) \times \frac{860 (\pm 2)}{1.637 (\pm 0.006)} \]

II. (3 pts) When a measured result is reported as 10.10 ± 0.12 cm, 68.3% of the population of measurements would be included in what range assuming a Gaussian distribution?

(3 pts) Considering the information above, what percent of the population would be included if in the value is reported as 10.10 ± 0.36?
VIII. (10 pts) Describe the preparation of 1.50 L of 0.215 M NaOH from concentrated commercial reagent (50% NaOH w/w; specific gravity = 1.525).