In a chemistry experiment, the concentration of Hydrogen ions $[H^+]$ in a solution changes over time during a titration process. The pH is defined by the formula:

$$\mathrm{pH} = -\log_{10}[H^+]$$

1. A solution has a Hydrogen ion concentration of $3.2 \times 10^{-5}\ \mathrm{mol/dm^3}$. Calculate its pH.
2. If the pH of the solution is decreased by 1.5 units, calculate the factor by which the Hydrogen ion

1. If the initial population is 500 cells and it grows to $1,500$ cells in 3 hours, find the exact value of k in terms of natural logarithms.
2. Determine how long it will take for the population to reach $10,000$ cells.
3. Why is a logarithmic scale often used to plot this growth instead of a linear scale?

The population of a bacteria culture in a laboratory at Makerere University grows according to the formula:

$$P(t) = P_0 e^{kt}$$

Where P_0 is the initial population, t is the time in hours, and k is the growth constant.

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2. If the pH of the solution is decreased by 1.5 units, calculate the factor by which the Hydrogen ion concentration has increased.
3. In a separate reaction, the concentration C of a reactant decreases such that $\ln C = -0.5t + \ln C_0$. Express C as a function of t.

amount A after t years is given by $A = Pe^{rt}$.

1. Show that the time t required for the investment to double is given by $t = \frac{\ln 2}{r}$.
2. Calculate the number of years (to the nearest month) it will take for the money to grow to $5,000,000$ UGX.
3. If the inflation rate is 5% per year, the "real value" V of the money follows $V = Ae^{-0.05t}$. Find the net growth rate of the real value of the investment.

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