TYPES OF CALCULATIONS

SPECTROPHOTOMETRY

1. Calculate molar absorption coefficient of oxidized form of cytochrome c, if absorbance of solution prepared by diluting of 0.35 ml of cytochrome solution with concentration 1 mmol.l^{-1} with 4.65 ml of H_2O is $A_{550} = 0.56$. Layer thickness is 0.5 cm. (ε=*16,000 mol^{-1}.l.cm^{-1}*)
2. Calculate concentration of glucose in serum, if in spectrophotometric determination by enzymatic method measured absorbance of sample is $A_{498} = 0.05$ and absorbance of standard solution with concentration 20 mmol.l^{-1} is $A_{498} = 0.16$. The same volumes of sample and standard were pipetted. (*c=6.25 mmol.l^{-1}*)
3. In spectrophotometric determination of urea in urine we measured absorbance at 525 nm . Absorbance of 100-times diluted urine sample was A = 0.065 and absorbance of standard urea solution with concentration 25 mmol.l^{-1} was A = 0.30. Calculate concentration of urea in not diluted urine and number of moles excreted in 24 hours if diuresis is 1.2 liter.(*c=541.7 mmol^{-1}; n=650 mmol/24 hours*)

SOLUTIONS

1. Calculate the mass of NaCl in 500 g of solution if the mass percentage of solution is w = 0.5 % *(2.5 g)*
2. Calculate mass percentage of glucose solution, which was prepared by dissolution of 0.5 g of glucose in 4.5 g of H_2O. *(10 %)*
3. Calculate the mass of KCl solution, mass percentage of which is w = 0.8 % and which contains 4 g of KCl. *(500 g)*
4. Mass concentration of albumin (Mr = 69 000) in blood plasma is 38 g.l^{-1}. What is amount of substance concentration of albumin? *(0.55 mmol.l^{-1})*
5. How many grams of NaCl and water is needed to prepare 900 g of NaCl solution, w = 0.8 % (w/w)? *(m_{NaCl}=7.2 g; m_{water}= 892.8 g)*
6. How many grams of glucose (Mr = 180) is needed to prepare 10 ml of glucose solution with concentration c = 0.5 mol/l? *(0.9 g)*
7. How many moles of NaCl does contain 0.1ml of NaCl solution with concentration 150 mmol/l? *(0.015 mmol)*
8. The volume 2 ml of a glucose solution with concentration 5 mmol.l^{-1} was diluted with 6 ml H_2O. Calculate concentration of resulting solution. *(1.25 mmol.l^{-1})*
9. Calculate the concentration of glucose solution, which was prepared by mixing of volume 15 ml glucose solution with concentration 5 mmol.l^{-1} with 25 ml glucose solution with concentration 4 mmol.l^{-1}. *(4.375 mmol.l^{-1})*
10. What volume of physiological solution is needed to adjust with water to volume 200 ml to obtain solution of NaCl with concentration 90 mmol.l^{-1} ? *(120 ml)*

11. The volume 0.5 ml of blood plasma contains 3.5 μg of bilirubin (M_r = 584.7). Calculate amount of substance concentration of bilirubin in blood plasma. *(11.97 μmol.l^{-1})*

OSMOLARITY, IONIC STRENGTH

1. Calculate amount of substance concentration of K_3PO_4 solution, which is isoosmotic (isotonic) with blood serum. *(0.075 mol.l^{-1})*
2. Calculate amount of substance concentration of $CaCl_2$ solution, which is isoosmotic with K_3PO_4 solution with concentration 5 mmol.l^{-1}. *(6.66 mmol.l^{-1})*
3. Calculate the ionic strength of $FeSO_4$ solution with concentration 0.02 mol.l^{-1}.*(0.08 mol.l^{-1})*
4. Calculate osmolarity and ionic strength of solution consisting of 0.05 mol.l^{-1} $Mg(NO_3)_2$ and 120 mmol.l^{-1} lactose. *(c_{osm} = 0.27 mol.l^{-1}; I = 0.15 mol.l^{-1})*
5. Calculate ionic strength and osmolarity of solution, which contains 30 mmol $Fe_2(SO_4)_3$, 0.01 mol $ZnCl_2$ and 120 mmol fructose in 500 ml of solution. *(c_{osm} = 0.6 mol.l^{-1}; I = 0.96 mol.l^{-1})*

pH, BUFFERS

1. pH of a solution is 5.5. Calculate molar concentration of H^+ and OH^- in this solution. *([H^+]=3.16×10^{-6} mol/l; [OH^-]=3.16×10^{-9} mol/l)*
2. Calculate pH of solution prepared by diluting of 10 ml HCl solution with concentration c = 1 mol.l^{-1} with water to final volume 100 ml. *(pH=1)*
3. Concentration of H^+ ions in gastric juice is 17 mmol.dm^{-3}. Calculate concentration of OH^- ions and pH of gastric juice. *(pH=1.77; [OH^-]=5.88×10^{-13} mol/l)*
4. Calculate how many milliliters of CH_3COOH solution have to be added to 40 ml of CH_3COONa solution (both with concentration 0.3 mol/l) to prepare buffer with pH = 5.5. pK(CH_3COOH) = 4.75. *(V_{acid}=7.12 ml)*
5. Calculate pH of hydrogen carbonate buffer consisting of H_2CO_3 and $NaHCO_3$ in 1 : 5 ratio. (pK = 6.1) *(pH=6.799)*
6. Calculate pH of buffer prepared by mixing of 20 ml of CH_3COOH and 80 ml of CH_3COONa (c = 0.1 mol.l^{-1}). (pK = 4.8) *(pH=5.402)*
7. Calculate pH of acetic acid solution with concentration 0.3 mol.l^{-1} (K = 1.8×10^{-5}). *(pH=2.634)*

ENZYMES

1. Calculate the activity of lactate dehydrogenase in katals per g of tissue. Absorbance of pyruvate standard solution (c = 2 mmol.l^{-1}) after 10 min. incubation time is 0.600 and absorbance of sample of homogenate (3%) is 0.450. *(0.083 μkatal/g)*
2. The activity of alpha amylase in 1 ml of the saliva is 50 U. How much is it in katal per liter of saliva? *(0.835×10^{-3} katal/g)*

3. The activity of alpha amylase in the saliva is 25 000 U/l. How much is it in katal? *(0.4175 $\times 10^{-3}$ katal)*
4. Calculate % of inhibition of arginase activity by L-lysine, when activity of enzyme without lysine is 0.75×10^{-6} catal/g and activity of arginase with lysine is 0.25×10^{-6} katal/g. *(66.7 %)*
5. Saccharase isolated from 1.5 g of tissue has changed of 0.45 mmol saccharose (to glucose and fructose) in 15 min. of incubation. Calculate the activity of saccharase in katals per g of tissue. *(0.33 μkatal/g)*