LABORATORIUM KIMIA FISIKA
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MATEMATIKA KIMIA
Logaritma

(Sumber : Barrante, Applied Mathematics fo Physical Chemistry, Bab 3)

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1. The apparent pH of an aqueous solution is defined by the equation $pH = -\log_{10}(H^+)$. Find the apparent pH of the following solutions:
   (a) $(H^+) = 1.00 \times 10^{-7} M$
   (b) $(H^+) = 0.111 M$
   (c) $(H^+) = 9.433 \times 10^{-9} M$
   (d) $(H^+) = 1.416 M$
   (e) $(H^+) = 5.44 \times 10^{-2} M$
   (f) $(H^+) = 12.0 M$
2. Given the following values for the apparent pH, find (H^+) in the following solutions:
   (a) $pH = 0$
   (b) $pH = 2.447$
   (c) $pH = 5.893$
   (d) $pH = 7.555$
   (e) $pH = -0.772$
   (f) $pH = 12.115$
3. Find the pH of a solution of HCl in which the HCl concentration is $1.00 \times 10^{-8} M$.
4. The work done in the isothermal, reversible expansion or compression of an ideal gas from volume V_1 to volume V_2 is given by the equation

$$w = -nRT \ln \frac{V_2}{V_1}$$

   where n is the number of moles of the gas, R is the gas constant $= 8.314$ J/mol · K, and T is the absolute temperature. Find the work done in the isothermal, reversible expansion of 1.00 mole of an ideal gas at 300K from a volume of 3.00 liters to a volume of 10.00 liters.

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5. The entropy change associated with the expansion or compression of an ideal gas is given by the equation

$$\Delta S = nC_v \ln \frac{T_2}{T_1} + nR \ln \frac{V_2}{V_1}$$

where n is the number of moles of the gas, C_v is the molar heat capacity at constant volume, T is the absolute temperature, and V is the volume. Find the change in entropy attending the expansion of 1.00 mole of an ideal gas from 1.00 liter to 5.00 liters, if the temperature drops from 300K to 284K. Take $C_v = \frac{3}{2}R$ and $R = 8.314$ J/mol · K.

6. It is well known that the change in entropy for an adiabatic reversible expansion of an ideal gas is equal to zero. Using the equation given in Problem 5, find the final temperature when an ideal gas at 300K expands adiabatically from 1.00 liter to 5.00 liters. Take $C_v = \frac{3}{2}R$ and $R = 8.314$ J/mol · K.

7. Radioactive decay is a first-order kinetics process which follows the integrated rate equation

$$\ln \frac{(A)}{(A)_0} = -kt$$

where (A) is the concentration of A at time t, $(A)_0$ is the concentration of A at $t = 0$ (the initial concentration of A), and k is a constant, called the rate constant. The fraction of ^{14}C found in a sample of wood ash from an archeological dig was found to be 0.664. How old is the wood ash, given that $k = 1.24 \times 10^{-4}$ yr^{-1} for the isotope ^{14}C.

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1. (a) 7.000
(b) 0.955
(c) 8.025
(d) −0.151
(e) 1.264
(f) −1.079

2. (a) $(H^+) = 1.000M$
(b) $(H^+) = 3.573 \times 10^{-3} M$
(c) $(H^+) = 1.279 \times 10^{-6} M$
(d) $2.786 \times 10^{-8} M$
(e) $5.916M$
(f) $7.674 \times 10^{-13} M$

3. pH = 6.98
4. work = −3003 J
5. $\Delta S = 12.70$ J/K
6. $T_2 = 103$ K
7. $t = 3300$ yr