LABORATORIUM KIMIA FISIKA
Jurusan Kimia - FMIPA
Universitas Gadjah Mada (UGM)

MATEMATIKA KIMIA
Metode Matematika Dalam Laboratorium

(Sumber : Barrante, Applied Mathematics fo Physical Chemistry, Bab 12)

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LATIHAN

1. Determine the probability of throwing a 2, 3, 4, 5, 6, 7, and 11 with a pair of honest dice.
2. From the following set of data,

Measurement	*Frequency*
5.61	2
5.62	11
5.63	18
5.64	30
5.65	35
5.66	27
5.67	14
5.68	9
5.69	4

determine:

(a) arithmetic mean
(b) standard error of a single measurement
(c) standard error of mean
(d) probable error of a single measurement
(e) probable error of mean
(f) average error

3. The volume of a cylindrical capillary tube is given by the expression $V = \pi r^2 h$, where r is the radius of the capillary tube and h is the height. If the radius of the capillary is found to be 0.030 cm with a probable error of ± 0.002 cm and the height of the capillary is found to be 4.0 cm with a probable error of ± 0.1 cm, what is the volume of the capillary tube and its probable error. What measurement must be made to a higher precision to decrease the probable error in the volume?
4. A student determines the volume of a pycnometer by filling the pycnometer with water and determining its mass. If the mass of the pycnometer plus water is 45.3218 g with a probable error of ± 0.0005 g, the mass of the pycnometer is 25.1011 g with a probable error of ± 0.0005 g, and the density of water at 25°C is 0.997044 g/cc, what is the volume of the pycnometer and its probable error? (Assume the error in the density of water to be negligible.)

LATIHAN

5. The molar mass of a vapor is determined by filling a bulb of known volume with the vapor at a known temperature and pressure and measuring its mass. This method is known as the Dumas method. If the vapor is assumed to be an ideal gas, then, from the ideal gas law,

$$M = \frac{mRT}{PV}$$

where M is the molar mass, m is the mass of the vapor, R is the gas constant, T is the absolute temperature, P is the pressure, and V is the volume. Given that

$m = 1.0339 \pm 0.0007$ g

$T = 274.0 \pm 0.5$ K

$P = 1.036 \pm 0.001$ atm

$V = 0.1993 \pm 0.0001$ liters

$R = 0.08205\ \text{l} \cdot \text{atm} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$ (no probable error)

determine the error in the molar mass.

6. On millimeter graph paper (using an expanded scale), plot the curve $y = x^3 - 3x^2 + x + 1$ from $x = -1$ to $x = +1$. Using the method of chords, find the slope of the curve at $x = 0$. Compare the slope found by this method to that found by differentiation.

7. On uniform graph paper (using an expanded scale), plot the curve $y = \frac{1}{2}x^2$ from $x = 0$ to $x = 4$. Determine the area under the curve from $x = 1$ to $x = 3$ by cutting out the area and determining its mass on an analytical balance. Next, determine the area by breaking up the area into small rectangles and determining the total area of the rectangles. Compare the areas found by these two methods to the actual area found by integration.

8. Prepare a graph of the data given in Problem 11-10 and determine the change in enthalpy of silver by graphical integration.

9. Prepare a graph of the data given in Problem 11-12 and determine the change in the entropy by graphical integration.

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1. (a) $\frac{1}{36}$
   (b) $\frac{1}{18}$
   (c) $\frac{1}{12}$
   (d) $\frac{1}{9}$
   (c) $\frac{5}{36}$
   (f) $\frac{1}{6}$
   (g) $\frac{1}{18}$

2. (a) 5.649^4
   (b) ± 0.02
   (c) ± 0.001
   (d) 0.012
   (e) 0.001
   (f) 0.014
3. $V = 0.0113 \pm 0.0015$ cc; radius must be measured to a higher precision.
4. $V = 20.2806 \pm 0.0007$ cc
5. $M = 112.58 \pm 0.25$ g/mol