Definirane greške

Apsolutna greška $\varepsilon_A = \Delta a$

Relativna greška $\varepsilon_R = \frac{\Delta a}{a}$

Ako se ima a i b i d, kad

- $a + b = d$ ili $a - b = d \rightarrow \Delta d = \Delta a + \Delta b$

  $\overset{!}{=} \varepsilon_A(a) + \varepsilon_A(b)$

- $a \cdot b = d$ ili $a/b = d \rightarrow \frac{\Delta d}{d} = \frac{\Delta a}{a} + \frac{\Delta b}{b}$

  $\varepsilon_R(d) = \varepsilon_R(a) + \varepsilon_R(b)$

- $d = a e^{\pm kb}$ $\qquad \frac{\Delta d}{d} = k \Delta b$

1. Ima se cilindar gdje $r = (12.05 \pm 0.05)\,mm$
i $h = (27.15 \pm 0.01)\,mm$

Izračunati volumen cilindra i njegovu grešku

$$A = \pi r^2 = \pi r r$$

$$V = A r$$

$$\pi = 3.14\,15926$$

$$A = 456.167\ mm^2$$

$$\Delta A = \left(\frac{\Delta r}{r} + \frac{\Delta r}{r}\right) A = 3.786\ mm^2$$

$$V = 12\,384.9\ mm^3 = 12.3849\ cm^3$$

$$\Delta V = \left(\frac{\Delta h}{h} + \frac{\Delta A}{A}\right) \cdot V = 0.1074\ cm^3$$

$$V = (12.4 \pm 0.1)\ cm^3$$

2. Dane su mjere

$a = (55 \pm 1)\,m$

$b = (8{,}3 \pm 0.1)\,m$

$d = (5.0 \pm 0.1)\,m$

Izračunati $k = \frac{a \times b}{d}$ i izraziti sa greškom

$$\frac{\Delta k}{k} = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta d}{d} = 0.05$$

$$\Delta K = \varepsilon_R(k) \cdot K = 4.5 = \varepsilon_A(k)$$

$$\Rightarrow \quad k = (91 \pm 5)\,m^2$$

4. $h = \frac{v^2}{2g}$ gibanje tijela

$v = (5.2 \pm 0.3)\,m/s$ $\quad g = (9.81 \pm 0.02)\,m/s^2$

odrediti h sa greškom

$$\frac{\Delta h}{h} = 2\frac{\Delta v}{v} + \frac{\Delta g}{g}$$

$h = 1.3781\,m$

$$\frac{\Delta h}{h} = 0.117$$

$\Delta h = 0.117 \cdot h = 0.1612\,m \Rightarrow \Delta h = 0.2m$

$h = (1.4 \pm 0.2)\,m$

5. $E_k = \frac{1}{2} m v^2$ kinetička energija

$v = (5 \pm 1)\,m/s$ i $m = (2.0 \pm 0.1)\,kg$

$$\frac{\Delta E_k}{E_k} = \frac{\Delta m}{m} + 2\frac{\Delta v}{v} = 0.45$$

$E_k \cdot 20\,\frac{kg\,m^2}{s^2}$ $\quad \Delta E_k = E_k \cdot \varepsilon_r(E_k) = 10\,\frac{kg\,m^2}{s^2}$

$E_k = (20 \pm 10)\,\frac{kg\,m^2}{s^2}$

Za dioaktivni izvor prati sljedeću jednadžbu

$$A_t = A_0 e^{-kt}$$

Ako je $t = (3.00 \pm 0.04)$ dana

$$k = 0.0547 \text{ dana}^{-1}$$

$$A_0 = 1.23 \times 10^3 / s$$

Izračunati A_t za $t = 3$ dana i njezinu grešku

$t = 3$ dana $\quad A_t = 1230 \times \frac{10^3}{s} e^{-(0.547/\text{dan}) \cdot 3\text{dana}}$

$$= 1.044 \times 10^3 \, s^{-1}$$

$$\frac{\Delta A_t}{A_t} = 0.0547/\text{dan} \; (0.04)\,\text{dan} = 0.0022$$

$$\Rightarrow A_t = (1.044 \pm 0.002) \times 10^3 / s$$