



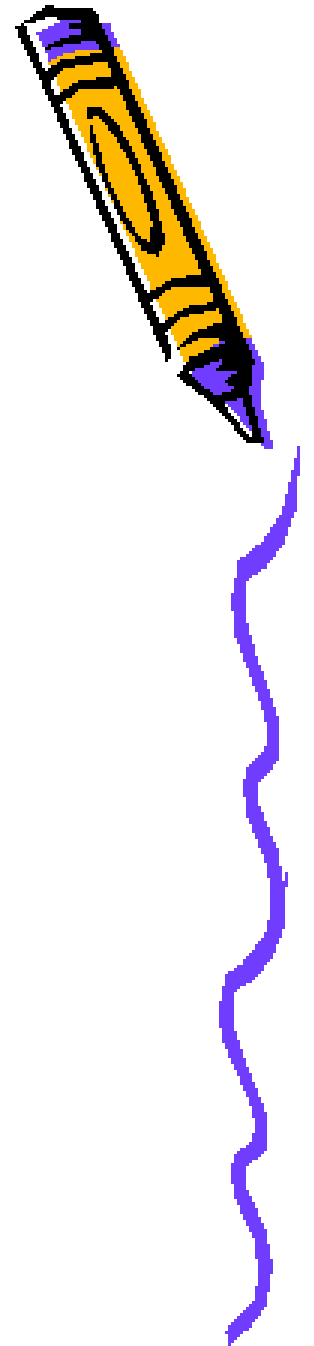
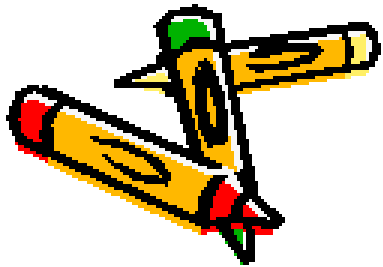
Kvantoptika-ülesanded

Füüsika
Antsla Gümnaasium
11 klass



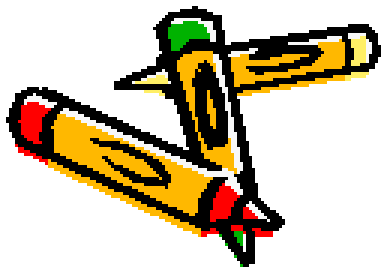
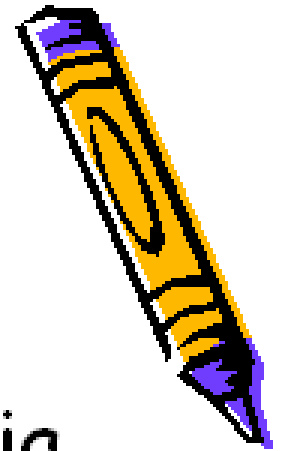
Kodune ülesanne

14.12



Tunnis

- Varasemate teadmiste kordamine ja kinnistamine
- Ülesannete lahendamisoskuse arendamine



Eeltheadmised

$$c = 3 \times 10^8 \frac{m}{s}$$

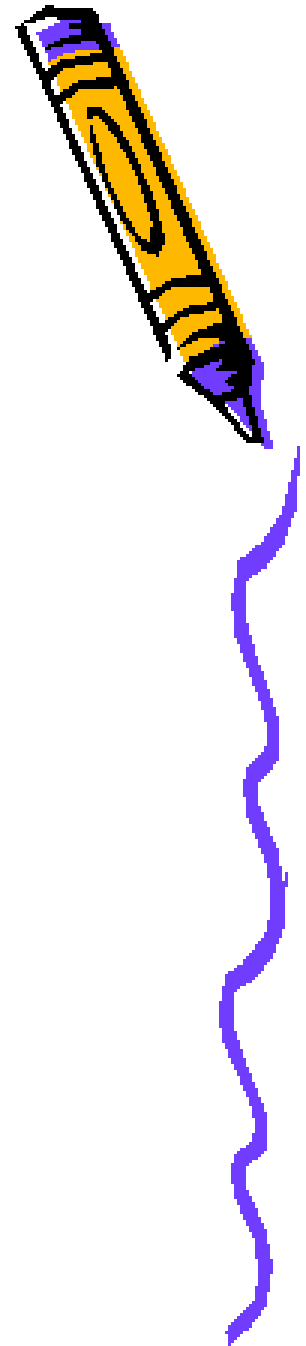
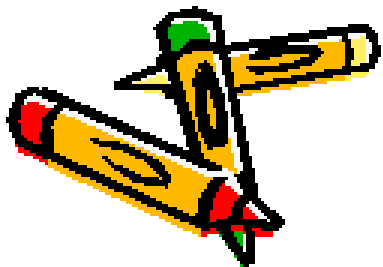
$$c = f \times \lambda$$

$$E = h \times f, \text{ kus } h = 6,6 \times 10^{-34} J \times s$$

$$E = A_v + E_k$$

$$h \times f = A + \frac{m \times v^2}{2}$$

$$f_p = \frac{A}{h}$$



Ülesanne 1

Milline on punase valguse sagedus?
Punase valguse lainepikkus on 760 nm.

Andmed

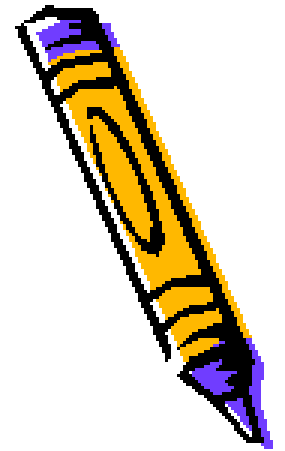
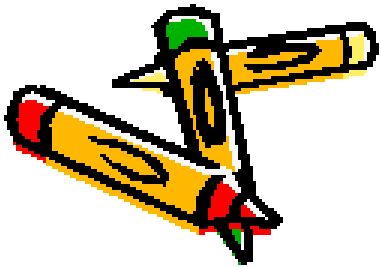
$$\lambda = 760 \text{ nm} = 7,6 \cdot 10^{-7} \text{ m}$$

$$c = 3 \cdot 10^8 \text{ m/s}$$

$$f = ? / \underline{\underline{3,9 \cdot 10^{14} \text{ Hz}}}$$

$$c = \lambda \cdot f$$

$$f = \frac{c}{\lambda}$$



$$f = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}}}{7,6 \cdot 10^{-7} \text{m}} = \underline{\underline{3,9 \cdot 10^{14} \text{ Hz}}}$$

$$f = 7,89 \text{ THz} = 7,89 \cdot 10^{12} \text{ Hz}$$

$$c = 3 \cdot 10^8 \text{ m/s} \quad \left| \quad c = \lambda \cdot f$$

$$\lambda = \frac{3 \cdot 10^8 \text{ m/s}}{7,89 \cdot 10^{12} \text{ Hz}}$$

$$\lambda = ? / \underline{3,8 \cdot 10^{-5} \text{ m}}$$

$$\lambda = \underline{3,8 \cdot 10^{-5} \text{ m}}$$

$$h = 6,6 \cdot 10^{-34} \text{ J} \cdot \text{s}$$
$$\lambda_R = 550 \text{ nm} = 550 \cdot 10^{-9} \text{ m}$$
$$f_K = 526 \text{ THz} = 526 \cdot 10^{12} \text{ Hz}$$

$$E_R = ?$$
$$E_K = ?$$

$$E = h \cdot f$$
$$E_K = 6,6 \cdot 10^{-34} \cdot 526 \cdot 10^{12} =$$
$$= 3,4716 \cdot 10^{-19} \text{ J}$$

$$E = h f$$

$$\lambda = \frac{c}{f} \Rightarrow f = \frac{c}{\lambda}$$

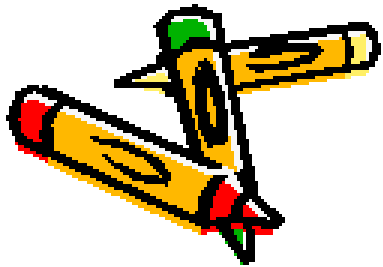
$$E = \frac{h \cdot c}{\lambda}$$

$$E_{\text{K}} = \frac{6,6 \cdot 10^{-34} \cdot 3 \cdot 10^8}{550 \cdot 10^{-9}} =$$

$$= \underline{\underline{3,6 \cdot 10^{-19} \text{ J}}}$$

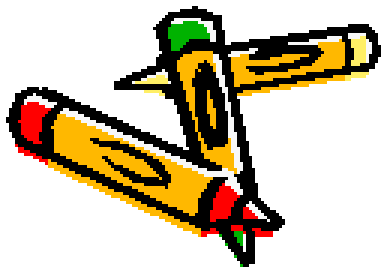
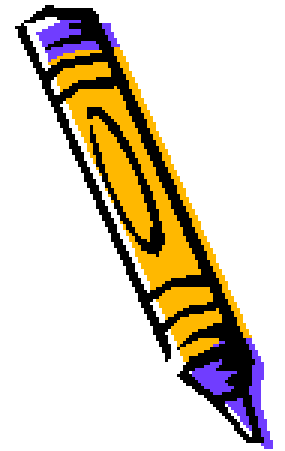


Alumiiniumi väljumistöö on 4,28 eV.
Leia fotoefekti punapiir



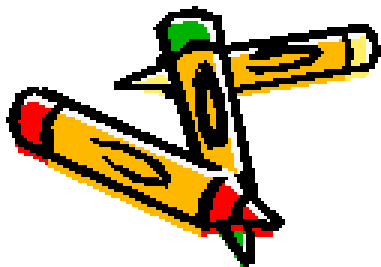
Ülesanne 4

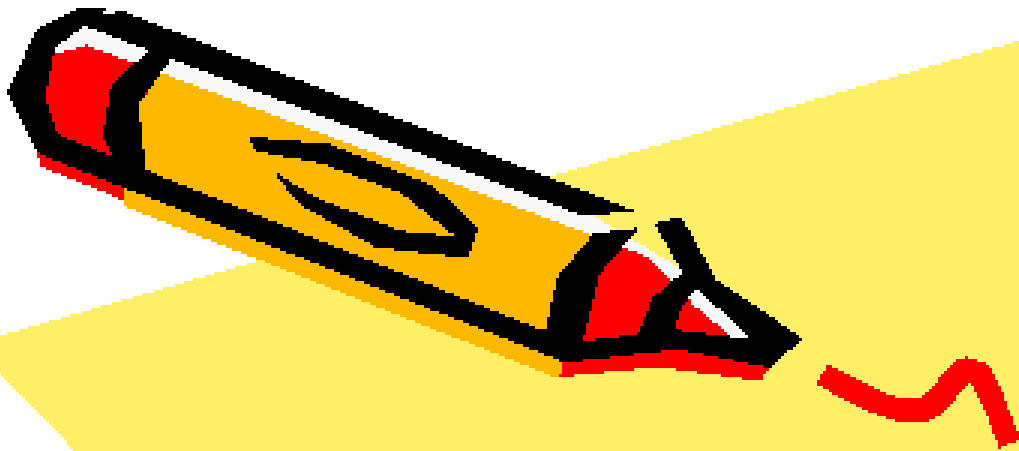
Fotoefekti punapiir raua jaoks on 178nm. Leia elektronide väljumistöö .



Ülesanne 5

Kui suur on baariumist välja löödud elektronide maksimaalne kiirus, kui seda kiiratakse elektromagnetlainega, mille lainepikkus on 50 nm? Baariumi väljumistöö on $2,52\text{eV}$.





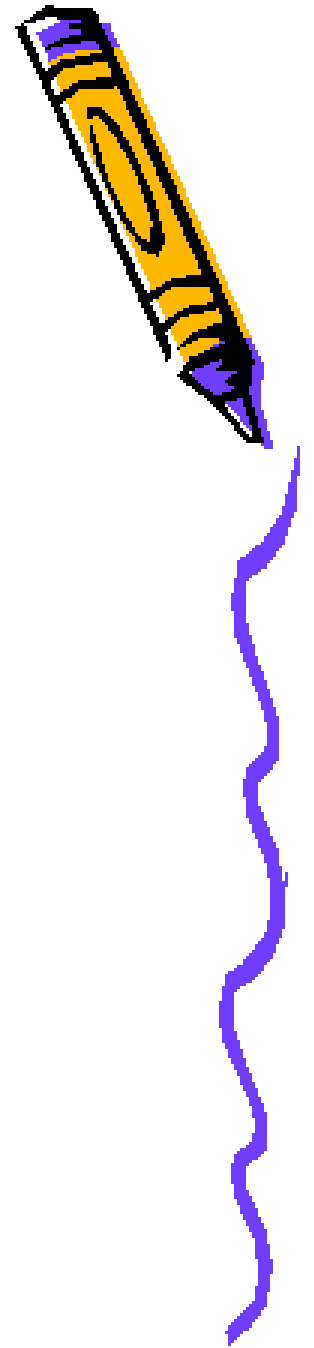
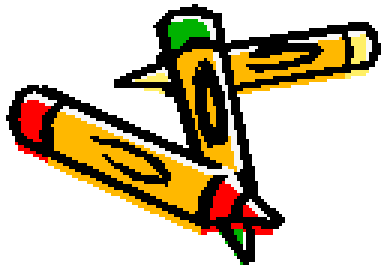
Kvantoptika-ülesanded

Füüsika
Antsla Gümnaasium
11 klass



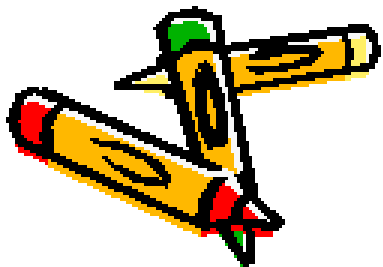
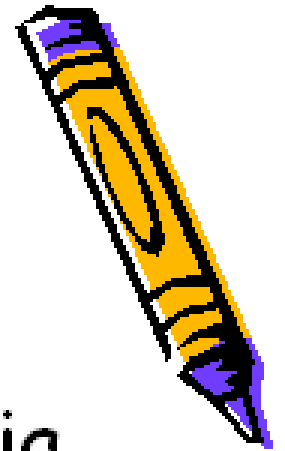
Kodune ülesanne

14.12



Tunnis

- Varasemate teadmiste kordamine ja kinnistamine
- Ülesannete lahendamisoskuse arendamine



Eeltheadmised

$$c = 3 \times 10^8 \frac{m}{s}$$

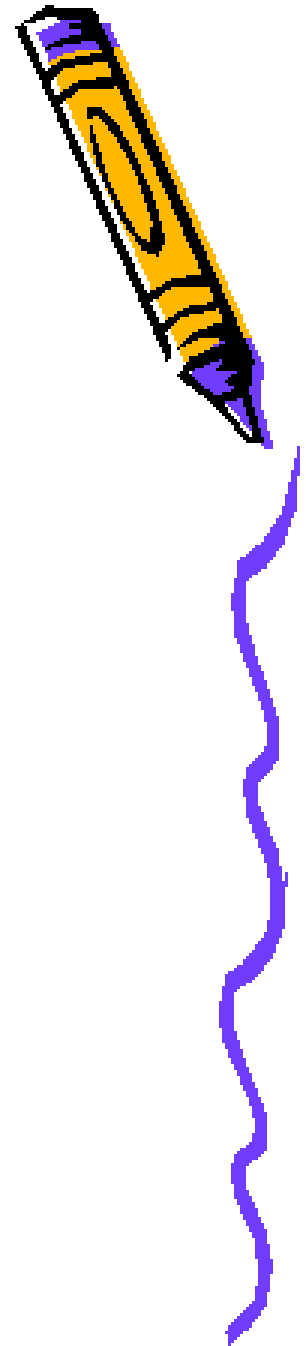
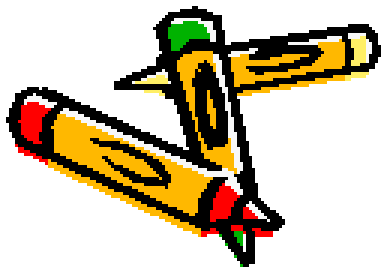
$$c = f \times \lambda$$

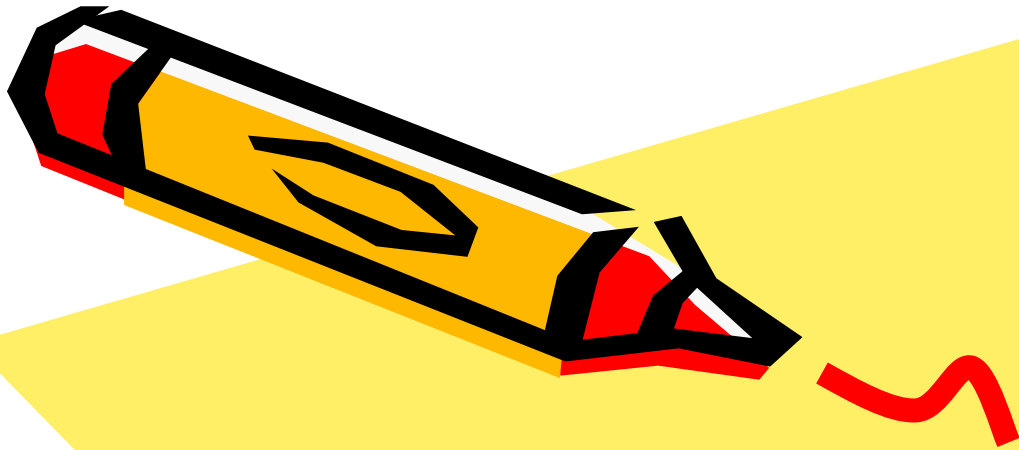
$$E = h \times f, \text{ kus } h = 6,6 \times 10^{-34} J \times s$$

$$E = A_\nu + E_k$$

$$h \times f = A + \frac{m \times v^2}{2}$$

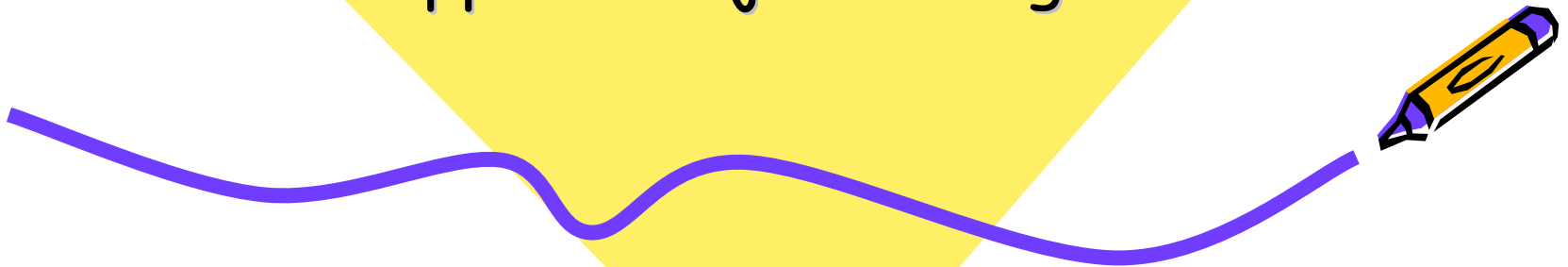
$$f_p = \frac{A}{h}$$





Tunnis lahendatud ülesanded

Õppematerjal: ül. kogu



Kodune ülesanne

14.14.

$$v = 2,5 \cdot 10^5 \text{ m/s}$$

$$A_v = 2,38 \text{ eV} = 2,38 \cdot 1,6 \cdot 10^{-19} \text{ J} = 3,8 \cdot 10^{-19} \text{ J}$$

$$1 \text{ eV} = 1,6 \cdot 10^{-19} \text{ J}$$

$$E_k = ? / 6,2 \cdot 10^{19} \text{ Hz}$$

$$A = ? / 3,8 \cdot 10^{-19} \text{ J}$$

$$E = ? / 9,1 \cdot 10^{-31} \text{ kg}$$

$$\lambda = ?$$
$$\lambda_p(\text{de}) = ?$$

$$1) E_k = \frac{mv^2}{2}$$

$$m(e^-) = 9,1 \cdot 10^{-31} \text{ kg}$$

$$v = 2,5 \cdot 10^5 \frac{\text{m}}{\text{s}}$$

$$h = 6,6 \cdot 10^{-34} \text{ J} \cdot \text{s}$$

$$E = A_v + E_k$$

$$E = h \cdot f \Rightarrow f = \frac{E}{h}$$

$$f_p = \frac{A_v}{h}$$

$$c = \lambda \cdot f_p \Rightarrow \lambda = \frac{c}{f_p}$$

$$E_k = \frac{9,1 \cdot 10^{-31} \cdot (2,5 \cdot 10^5)^2}{2}$$

$$E_k = 2,8 \cdot 10^{-20} \text{ J}$$

$$E = (3,8 \cdot 10^{-19} + 2,8 \cdot 10^{-20}) \text{ J}$$

$$E = 4,1 \cdot 10^{-19} \text{ J}$$

$$f = \frac{4,1 \cdot 10^{-19} \text{ J}}{6,6 \cdot 10^{-34} \text{ J} \cdot \text{s}} = 6,2 \cdot 10^{14} \text{ Hz}$$

$$\lambda = \frac{c \cdot h}{A_v}$$

$$\lambda = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}} \cdot 6,6 \cdot 10^{-34} \text{ J} \cdot \text{s}}{3,8 \cdot 10^{-19} \text{ J}}$$

$$\lambda = 5,2 \cdot 10^{-7} \text{ m} = \underline{\underline{520 \text{ nm}}}$$

$$c = 3 \cdot 10^8 \frac{\text{m}}{\text{s}}$$

$$f = 6,2 \cdot 10^{14} \text{ Hz}$$

$$\lambda = ?$$

$$c = f \cdot \lambda$$

$$\lambda = \frac{c}{f}$$

$$\lambda = 4,9 \cdot 10^{-7} \text{ m} =$$
$$= \underline{\underline{490 \text{ nm}}}$$

Värms; helesimike

$$\lambda = 760 \text{ nm} = 7,6 \cdot 10^{-7} \text{ m}$$

$$c = 3 \cdot 10^8 \text{ m/s}$$

$$f = 3,9 \cdot 10^{14} \text{ Hz}$$

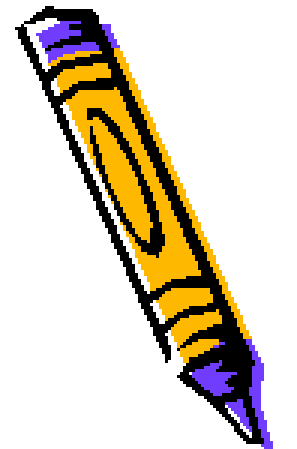
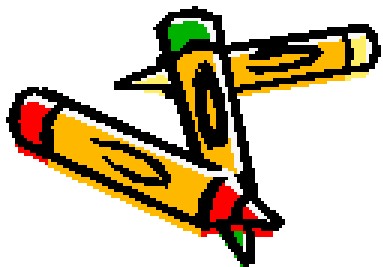
$$f = \frac{c}{\lambda}$$

$$f = \frac{3 \cdot 10^8}{7,6 \cdot 10^{-7}} =$$
$$= \underline{\underline{3,9 \cdot 10^{14} \text{ Hz}}}$$

Ülesanne 2

Milline on violetse valguse
lainepikkus? Violetse valguse sagedus
on 7,89 THz

$$f = 7,89 \cdot 10^{12} \text{ Hz}$$
$$c = 3 \cdot 10^8 \text{ m/s}$$
$$\lambda = ?$$
$$\lambda = \frac{c}{f}$$



Andmed

$$c = 3 \cdot 10^8 \frac{\text{m}}{\text{s}}$$

$$f = 4,89 \cdot 10^{12} \text{ Hz}$$

$$\lambda = \underline{\underline{3,8 \cdot 10^{-5} \text{ m}}}$$

Laendus.

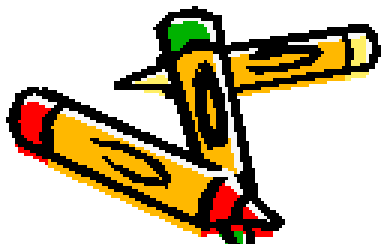
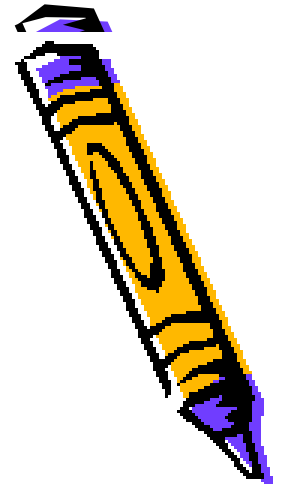
$$c = \lambda \cdot f \Rightarrow \lambda = \frac{c}{f}$$

$$\lambda = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}}}{4,89 \cdot 10^{12} \frac{1}{\text{s}}}$$

$$\lambda = \underline{\underline{3,8 \cdot 10^{-5} \text{ m}}}$$

Ülesanne 3

Leia roheline ja kollase valguse kvandile vastavad energiad. Rohelise valguse lainepikkus on 550 nm, kollase valguse sagedus on 526 THz.



$$f_{\text{kollane}} = 526\text{THz} = 526 \times 10^{12} \text{ Hz}$$

$$\lambda_{\text{roheline}} = 550\text{nm} = 550 \times 10^{-9} \text{ m} = 5,5 \times 10^{-7} \text{ m}$$

$$h = 6,6 \times 10^{-34} \text{ J} \times \text{s}$$

$$c = 3 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$E_{\text{kollane}} = ?$$

$$E_{\text{roheline}} = ?$$

$$E = h \times f$$

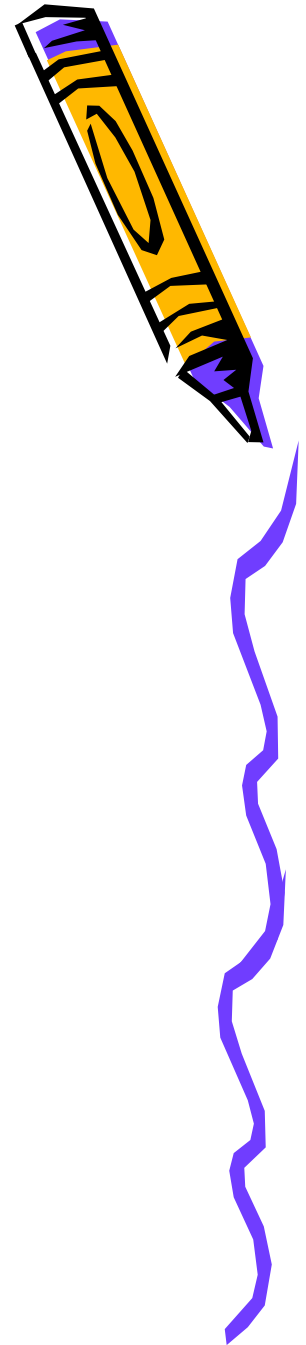
$$c = \lambda \times f \Rightarrow \lambda = \frac{c}{f}$$

$$E_{\text{kollane}} = 526 \times 10^{12} \text{ Hz} \times 6,6 \times 10^{-34} \text{ J} \times \text{s}$$

$$E_{\text{kollane}} = 3,5 \times 10^{-19} \text{ J}$$

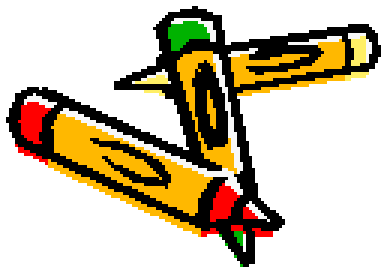
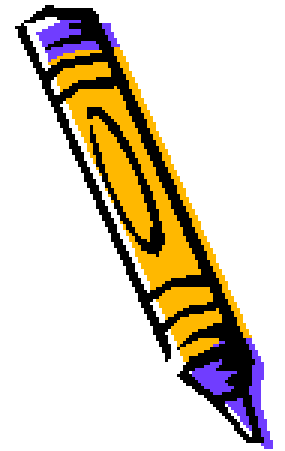
$$E_{\text{roheline}} = h \times \frac{c}{\lambda}$$

$$E_{\text{roheline}} = 6,6 \times 10^{-34} \text{ J} \times \text{s} \times \frac{3 \times 10^8 \frac{\text{m}}{\text{s}}}{5,5 \times 10^{-7} \text{ m}} = 3,6 \times 10^{-19} \text{ J}$$



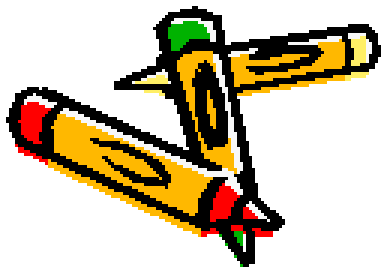
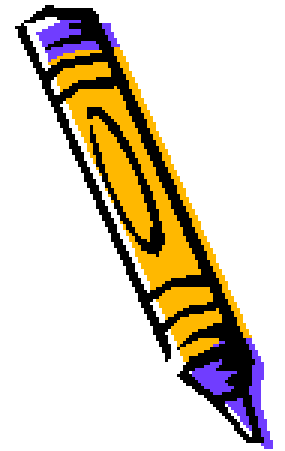
Ülesanne 4

Alumiiniumi väljumistöö on 4,28 eV.
Leia fotoefekti punapiir



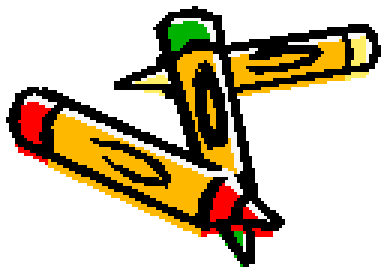
Ülesanne 5

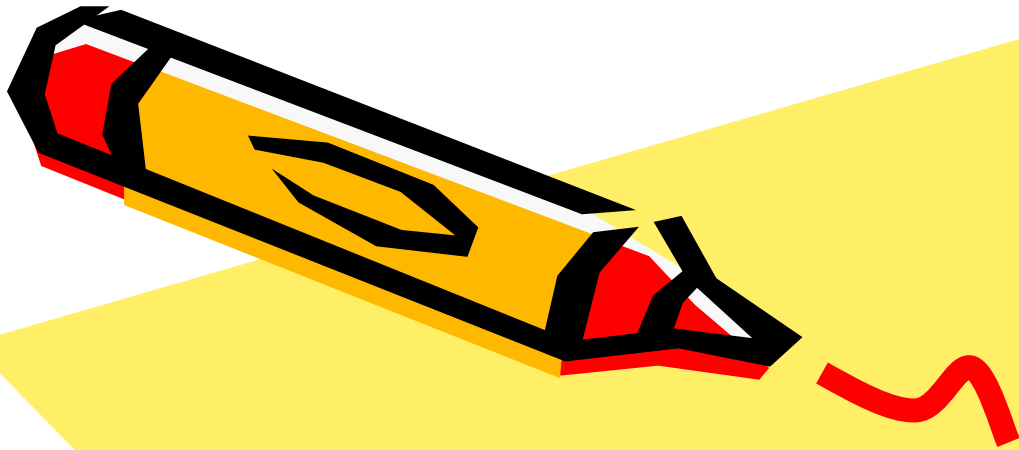
Fotoefekti punapiir raua jaoks on 178nm. Leia elektronide väljumistöö .



Ülesanne 6

Kui suur on baariumist välja löödud elektronide maksimaalne kiirus, kui seda kiiratakse elektromagnetlainega, mille lainepikkus on 50 nm? Baariumi väljumistöö on $2,52\text{eV}$.





Tublid!

Edukat õppimist😊😊😊

