

Inteferentsi ülesanded

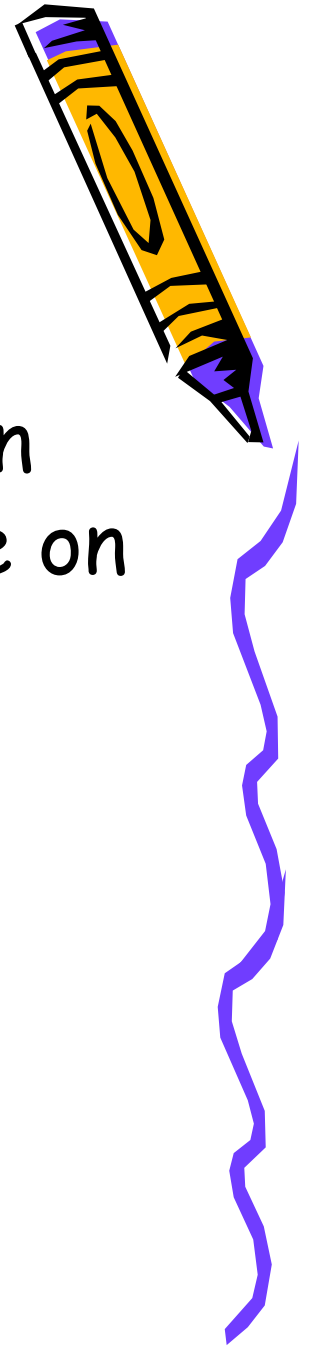
Füüsika
11 klass
Antsla Gümnaasium



Ülesanne 1

Kaks valguslainet, mille lainepikkus on 600 nm liituvad punktis P. Milline on liitumistulemus, kui käiguvahe on:

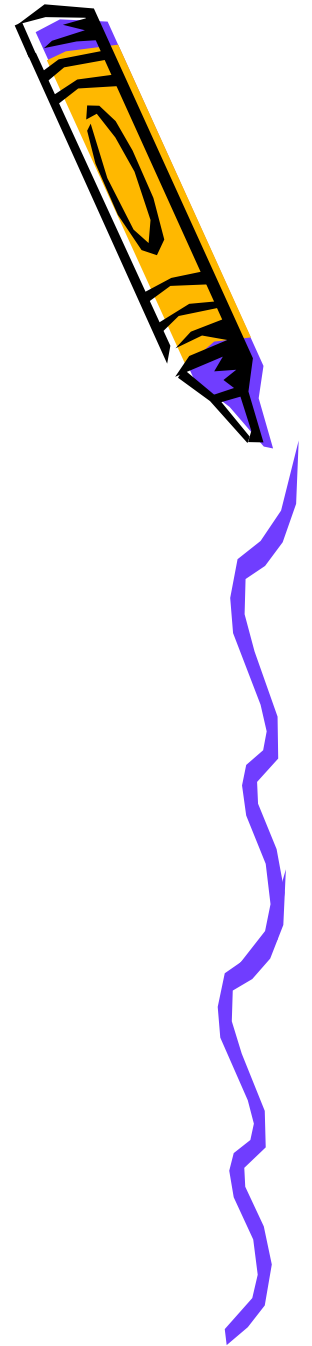
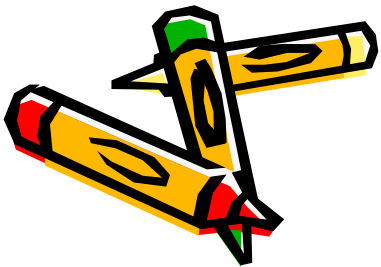
- a) 300nm
- b) 600nm
- c) 900 nm



Lained tugevdavad
teineteist:

$$\Delta = 2 \times k \times \frac{\lambda}{2}$$

$$\Delta = k \times \lambda \Rightarrow k = \frac{\Delta}{\lambda}$$



Ülesanne 1

a) Andmed:

$$\lambda = 600\text{nm}$$

$$\Delta = 300\text{nm}$$

$$k = ?$$

Maksimumi korral:

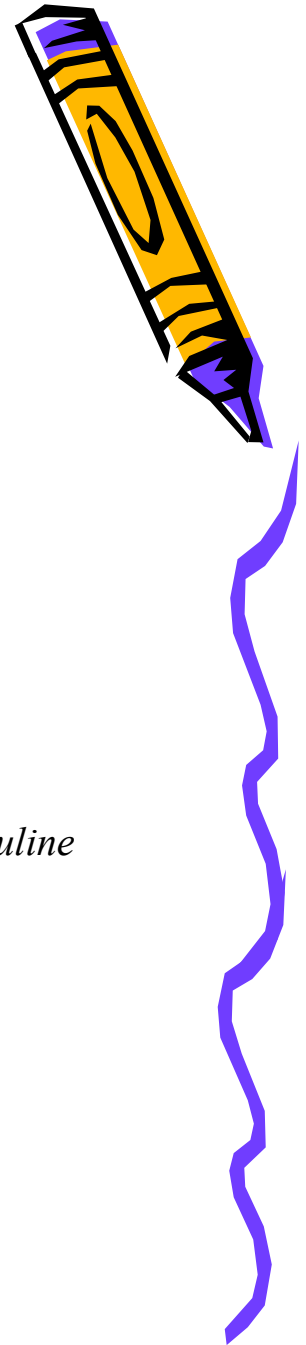
$$\Delta = k \times \lambda \Rightarrow k = \frac{\Delta}{\lambda}$$

$$\int k = \frac{300\text{nm}}{600\text{nm}} = 0,5 \Rightarrow \text{Seega maksimum ei saa olla, kuna } k \text{ pole täisarvuline}$$

Miinimumi korral:

$$\Delta = (2k + 1) \times \lambda \Rightarrow k = \frac{\left(\frac{\lambda}{2} - \Delta\right)}{\lambda}$$

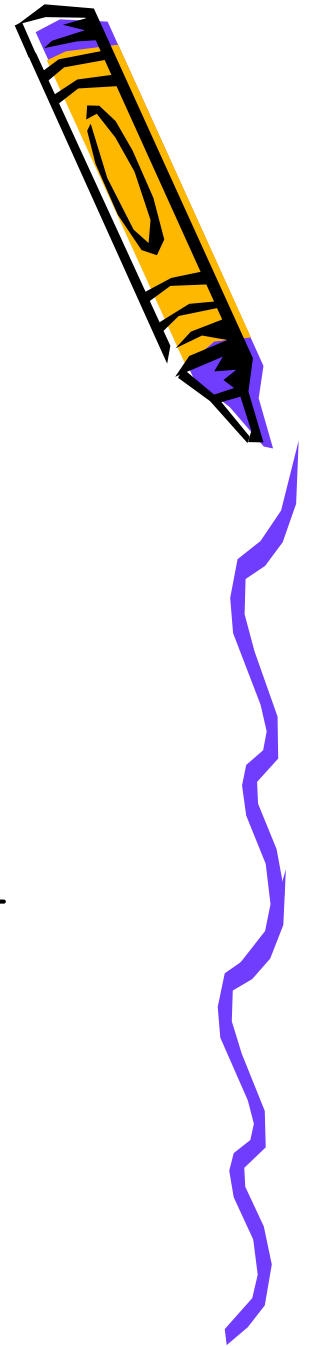
$$k = \frac{\frac{600\text{nm}}{2} - 300\text{nm}}{600\text{nm}} = 0 \Rightarrow \text{esineb miinimum ehk lainet nõrgenemine}$$



Lained nõrgendavad teineteist:

$$\Delta = (2 \times k + 1) \times \frac{\lambda}{2}$$

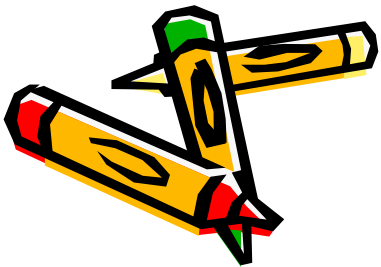
$$\Delta = \left(k + \frac{1}{2} \right) \times \lambda \Rightarrow k = \frac{\left(\frac{\lambda}{2} - \Delta \right)}{\lambda}$$



Ülesanne 2

Jälgitakse kahe valguslaine
inteferentsi($\lambda=550$ nm). Millise
käiguvahe puhul esineb teist järku:

- a) maksimum
- b) miinimum



Ülesanne 2

a) Andmed:

$$\lambda = 550\text{nm}$$

$$k = 2(\text{teist järku})$$

$$\Delta = ?$$

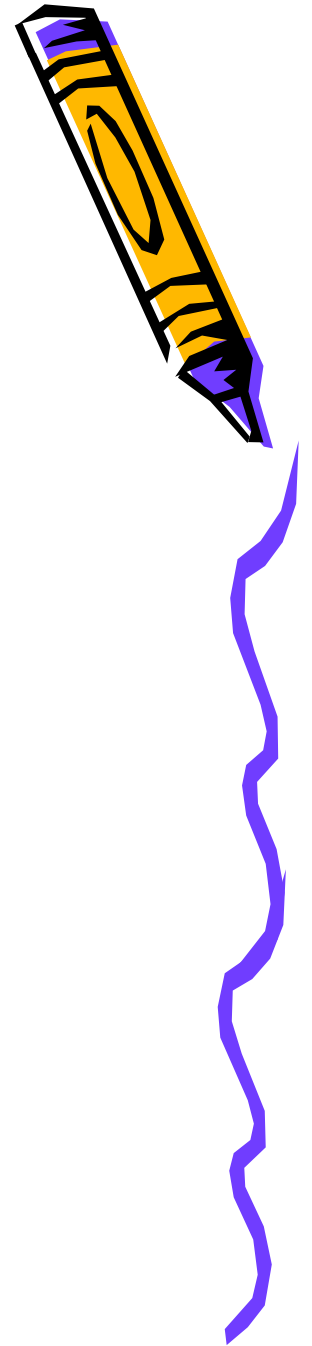
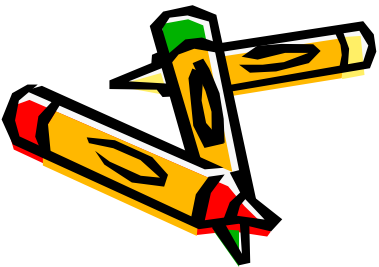
$$\Delta = k \times \lambda$$

$$\Delta = 550\text{nm} \times 2 = \mathbf{1100\text{nm}}$$

b) Teist järku miinimum:

$$\Delta = \frac{(2k + 1) \times \lambda}{2}$$

$$\Delta = \frac{(2 \times 2 + 1) \times 550\text{nm}}{2} = \mathbf{1375\text{nm}}$$



Ülesanne 3

Kahe punktvalgusallika vahekaugus on $2 \cdot 10^{-5}$ m, kiirguva valguse lainepikkus on 400nm. Millise nurga all sümmeetriatelje suhtes tekib:

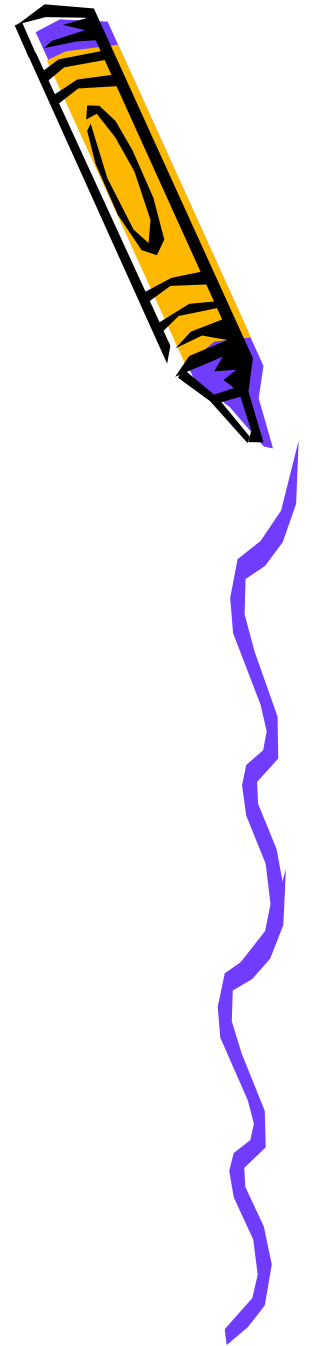
- a) esimene maksimum
- b) teine maksimum



Intefrentsi maksimum

$$d \times \sin \alpha = k \times \lambda$$

$$\Rightarrow \sin \alpha = \frac{k \times \lambda}{d}$$



Ülesanne 3

Andmed:

$$d = 2 \times 10^{-5} \text{ m}$$

$$\lambda = 400 \text{ nm} = 400 \times 10^{-9} \text{ m} = 4 \times 10^{-7} \text{ m}$$

$$k = 1$$

$$\alpha = ?$$

Lahendus:

$$d \times \sin \alpha = k \times \lambda \Rightarrow \sin \alpha = \frac{k \times \lambda}{d}$$

$$\sin \alpha = \frac{1 \times 4 \times 10^{-7} \text{ m}}{2 \times 10^{-5} \text{ m}}$$

$$\sin \alpha = 0,02$$

$$\alpha = 1,15^\circ$$

