

Competition in biophysics/medical biophysics 2012.

1. What is the wavelength of ultrasound of 833 kHz frequency in a solution, where the velocity of it is 1800 m/s? How many percentage of ultrasound passes through the boundary of the solution and the glass if the velocity of ultrasound in the glass is 5.77 km/s, the density of solution and glass are 1.2 g/cm^3 and 2500 kg/m^3 , respectively. (25 points)
2. There is 5 cm thick lead wall in front of an isotope in an isotope laboratory. Using this the dose obtained by the person doing the measurement is $100 \text{ } \mu\text{Gy}$. Without lead wall the dose rate is 1 mGy/hour . How large is the half value thickness of lead for this radiation if the duration of one measurement is 2 hours? (20 points)
3. A CO_2 laser used in laser surgery produces light of $10.6 \text{ } \mu\text{m}$ wavelength. When the laser light is focused to a circular area of $100 \text{ } \mu\text{m}$ diameter on the skin surface the obtained intensity is 2.5 GW/m^2 . What is the number of photons arriving at the skin surface in one second? (30 points)
4. The average velocity of blood in the aorta of 2.4 cm diameter is 25 cm/s. What is the total cross section of arterioles if a red blood cell takes 2 mm in one of them in 0,8 s. What is the average diameter of these arterioles if the number of parallel branches is 60 million? (25 points)
5. Give short definitions for the following terms (give the unit, where it is possible) 6x5 points)
 - Visual acuity
 - Fluorescence lifetime
 - Effective dose
 - Unipolar ECG lead
 - Electrochemical potential
 - Action potential
6. Describe the following phenomena or principles (5x8 points)
 - Pair production
 - Stochastic radiation effect
 - Differential amplifier
 - Inverse piezoelectric effect
 - Stevens' law
7. Describe the structure and function of film dosimeter and thermoluminescent dosimeter. Compare them. (Similarities, differences, advantages, disadvantages). (30 points)

Angol verseny 2011/2012 megoldások és pontozás

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|----|---|---------|
| 1. | $\lambda = 2.16 \text{ mm}$ | 10 pont |
| | $R = 0.55$ | 10 pont |
| | $1 - 0.55 = 0.45 \rightarrow 45 \%$ | 5 pont |
| 2. | $x/D = 4.32$ | 20 pont |
| 3. | $A = 7.85 \times 10^{-9} \text{ m}^2$ | 10 pont |
| | $E = 19.6 \text{ J}$ | 5 pont |
| | egy foton energiája: $1,86 \times 10^{-20} \text{ J}$ | 10 pont |
| | $n = 1.05 \times 10^{21}$ | 5 pont |
| 4. | $A = 452.4 \text{ cm}^2$ | 12 pont |
| | egy ág keresztmetszete $754 \mu\text{m}^2$ | 5 pont |
| | $r = 15.5 \mu\text{m}$ | 5 pont |
| | $d = 31 \mu\text{m}$ | 3 pont |

Általános javítási elvek: számolási hiba: 20 % levonás,
mértékegység hiba vagy hiány: 25 % levonás,
átváltási hiba darabonként 25 % levonás,
elvi hiba: 50 % levonás.

A kedvezmény feltétele : összesen legalább 100 pont elérése.

A kedvezményt elérték dolgozatát kérem **május 11-én 12 óráig**.
(Ha valaki kedvezményt kap, a versenydolgozat tekintendő a vizsga írásbeli részének, tehát meg kell őrizni.) Akkor is kérek visszajelzést, ha a csoportból senki nem kap kedvezményt.
Kérem, hogy az egyeztetés előtt senki ne mondjon semmit a hallgatóinak az elért versenykedvezményről!

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