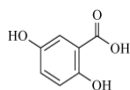


Passage 1 (Questions 1-6)

Matrix-Assisted-Laser-Desorption/Ionization (MALDI) is a soft ionization technique used in conjunction with mass spectrometry (MS) to analyze proteins, protein fragments, and peptides. In MALDI, a plate containing the sample is coated with 2,5-dihydroxybenzoic acid (DHB) (structure shown).



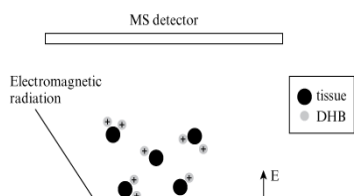
2,5-Dihydroxybenzoic acid

The coated plate is subsequently subject to pulsed electromagnetic radiation whose characteristics are summarized in Table 1.

Table 1 Characteristics of Electromagnetic Radiation Used in the MALDI Technique

Wavelength (nm)	Power (mW)	Pulse duration (ms)
266	1.5	5
325	2.2	2

The radiation ionizes the DHB in the setup shown in Figure 1.



Periodic table

Which laser is suitable for the MALDI technique after its frequency is doubled?

Foundational Concept: 4

Complex living organisms transport materials, sense their environment, process signals, and respond to changes using processes that can be understood in terms of physical principles.

Content Category: 4A

Translational motion, forces, work, energy, and equilibrium in living systems

Scientific Inquiry and Reasoning Skill: 3

Reasoning about the Design and Execution of Research

Discipline:

Physics

- ☐ A. Laser A: wavelength 826 nm, power 1.2 mW
- ☐ B. Laser B: wavelength 714 nm, power 1.2 mW
- ☒ C. Laser C: wavelength 650 nm, power 1.5 mW
- ☐ D. Laser D: wavelength 532 nm, power 1.5 mW

This is a Physics question that falls under the content category "Translational motion, forces, work, energy and equilibrium in living systems." The answer to this question is D because the wavelength must be either 266 nm or 325 nm, and by doubling the frequency of the laser whose wavelength is 532 nm, the resulting wavelength is $532 \text{ nm}/2 = 266 \text{ nm}$, because electromagnetic radiation wavelength and frequency are inversely proportional to each other. Also, the power of the radiation must be 1.5 mW. It is a Reasoning about the Design and Execution of Research question because you must reason about the appropriateness of tools used to conduct natural sciences research, such as lasers.

I missed this question because I... Did not know the answer, and guessed incorrectly.