

Reading 1

Questions 1 - 10

The word laser was coined as an acronym for Light Amplification by the Stimulated Emission of Radiation. Ordinary light, from the Sun or a light bulb, is emitted spontaneously, when atoms or molecules get rid of excess energy by themselves, without any outside intervention. Stimulated emission is different because it occurs when an atom or molecule holding onto excess energy has been stimulated to emit it as light.

Line
(5)

Albert Einstein was the first to suggest the existence of stimulated emission in a paper published in 1917. However, for many years physicists thought that atoms and molecules always were much more likely to emit light spontaneously and that stimulated emission thus always would be much weaker. It was not until after the Second World War that physicists began trying to make stimulated emission dominate. They sought ways by which one atom or molecule could stimulate many others to emit light, amplifying it to much higher powers.

(10)

The first to succeed was Charles H. Townes, then at Columbia University in New York. Instead of working with light, however, he worked with microwaves, which have a much longer wavelength, and built a device he called a "maser," for Microwave Amplification by the Stimulated Emission of Radiation. Although he thought of the key idea in 1951, the first maser was not completed until a couple of years later. Before long, many other physicists were building masers and trying to discover how to produce stimulated emission at even shorter wavelengths.

(15)

The key concepts emerged about 1957. Townes and Arthur Schawlow, then at Bell Telephone Laboratories, wrote a long paper outlining the conditions needed to amplify stimulated emission of visible light waves. At about the same time, similar ideas crystallized in the mind of Gordon Gould, then a 37-year-old graduate student at Columbia, who wrote them down in a series of notebooks. Townes and Schawlow published their ideas in a scientific journal, *physical Review Letters*, but Gould filed a patent application. Three decades later, people still argue about who deserves the credit for the concept of the laser.

(20)

(25)

1. The word "coined" in line 1 could best be replaced by
 - (A) created
 - (B) mentioned
 - (C) understood
 - (D) discovered
2. The word "intervention" in line 4 can best be replaced by
 - (A) need
 - (B) device
 - (C) influence
 - (D) source

3. The word "it" in line 5 refers to
- (A) light bulb
 - (B) energy
 - (C) molecule
 - (D) atom
4. Which of the following statements best describes a laser?
- (A) A device for stimulating atoms and molecules to emit light
 - (B) An atom in a high-energy state
 - (C) A technique for destroying atoms or molecules
 - (D) An instrument for measuring light waves
5. Why was Towne's early work with stimulated emission done with microwaves?
- (A) He was not concerned with light amplification.
 - (B) It was easier to work with longer wavelengths.
 - (C) His partner Schawlow had already begun work on the laser.
 - (D) The laser had already been developed.
6. In his research at Columbia University, Charles Townes worked with all of the following EXCEPT
- (A) stimulated emission
 - (B) microwaves
 - (C) light amplification
 - (D) a maser
7. In approximately what year was the first maser built?
- (A) 1917
 - (B) 1951
 - (C) 1953
 - (D) 1957
8. The word "emerged" in line 20 is closest in meaning to
- (A) increased
 - (B) concluded
 - (C) succeeded
 - (D) appeared
9. The word "outlining" in line 21 is closest in meaning to
- (A) assigning
 - (B) studying
 - (C) checking
 - (D) summarizing
10. Why do people still argue about who deserves the credit for the concept of the laser?
- (A) The researchers' notebooks were lost.
 - (B) Several people were developing the idea at the same time.
 - (C) No one claimed credit for the development until recently.
 - (D) The work is still incomplete.