

Reading Explorer 5 Final

DIRECTIONS: Choose the best answer for each question.

Light Engineering

[A] We use light today for everything from laser eye surgery to telephone technology. In fact, the more you look at the topic, the more you realize that our lives are built around light, that our daily existence is continuously shaped - and made vivid - by that ambiguous stuff that dates from the beginning of time.

[B] "This is a very pure, straight beam." Charles Townes was showing me a helium-neon laser in his laboratory at the University of California at Berkeley. He has hundreds of lasers, including some that arrive in the mail as gifts, lasers smaller than matchboxes, green lasers soothing to the eye - all the various descendants of technology that Townes, together with his brother-in-law Arthur Schawlow, invented in the 1950s.

[C] Light normally spreads out rapidly in all directions; a laser coheres and amplifies the light in a narrow beam. The key to producing this beam is the basic atomic principle that says that photons - light as particles - can be captured or emitted by atoms. When an electron changes from a high-energy, or excited, state to a low-energy state, its atom will emit a photon. A laser exploits this process.

[D] A laser starts with a crystal or other medium whose atoms are prone to excitement. These atoms are hit with light, causing their electrons to do a little dance. When they calm down, they release excess energy as photons. Those photons, in turn, induce more electron dancing, which creates more photons - a chain reaction. It is physics, not magic, that causes more light to come out than went in.

[E] The arrival of the laser was greeted by some parts of the media as the start of a new era of military death rays, similar to the Martian Heat-Ray in H. G. Wells' *The War of the Worlds*. But a half century ago, Townes and Schawlow weren't actually sure what could be done with their invention. They just knew they'd figured out a way to make light shine strong and straight.

[F] It's hard to overstate the usefulness of a tool that makes light shine straight. "People used to kid me, 'Lasers are a solution looking for a problem,'" Townes says. He thinks about that every time he goes to the checkout line at the grocery store, where light is used to scan the price of every product. When you make a long-distance phone call, your words are transmitted by laser light along a fiber-optic cable. A laser reads the CD in a CD player. "When a friend comes to me and says laser surgery saved his eyesight, that's a very emotional thing," Townes says.

[G] The world's largest laser is about an hour east of San Francisco, in the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory. The laser is actually 192 individual beams of light, grouped in bundles of four, which travel the length of a building 213 meters long and 122 meters wide. Each laser bounces off a mirror into a target chamber - a 9-meter diameter sphere that looks somewhat like an enormous golf ball from outer space.

[H] Inside the chamber the laser beams crash into a gold-plated cylinder containing a gas-filled pellet. The gases in the pellet, under the pressure of all this light, compress to the point where they induce nuclear fusion. "The goal is to create a miniature star in the laboratory," says Ed Moses, the NIF project manager. In the long term, the scientists at NIF hope to clear a path toward a source of cheap, endless, pollution-free electricity.

[I] According to physicist Vaughn Draggoo, "NIF will produce more power in a one-nanosecond laser pulse than all the power generated in the rest of the world at that moment." How is it that light is such a useful source of energy? "Because you can compress a lot of light's energy in a very small point," says Moses. Children, he notes, discover this when they play with a magnifying glass on a sunny summer day. Here we come to one facet of the miracle of light. It has no volume. And photons have no charge, so when they are concentrated into a very small space, they don't repulse each other as negatively charged electrons do. "They don't bother one another" is the way Moses puts it.

[J] The telecommunications industry loves light. When you visit Lucent Technologies Bell Labs in Holmdel, New Jersey, you're greeted with a sign saying, "Welcome to Photon Valley."

[K] Kathy Szelag, a vice president with Lucent's Optical Networking Group, told me, "People like my parents think we're in the *Star Wars* part of optical networking. We're really in the crude oil part of optical networking. We're just at the beginning." Her colleague Bob Windeler, an optical-fiber researcher, added, "The amount of information you can put on a fiber more than doubles every year." In theory a single fiber could someday transmit every phone call on Earth simultaneously.

[L] Lasers are used to beam different wavelengths of infrared light down a single fiber. Each wavelength is its own data channel - its own pipe. Right now, a fiber can carry dozens of these channels, but that could become thousands or even millions. "It's as close to a miracle as there is," says Dave Bishop, Lucent's vice president of optical research.

[M] George Gilder, an influential technology guru, has declared that light will be the medium of a communications revolution. "You can envision a point where everyone in the world could have his own wavelength," says Gilder. "You'd have one wavelength that connected you to the person you wanted to address in Vienna or Tokyo or Tierra del Fuego, and this wavelength could easily accommodate three dimensional images. You could have conversations in which you forget within literally seconds that the person is not present. You see a face, the image saturates your own optical capabilities."

[N] Modern physics emerged from the study of matter and light. Modern cosmology, including the revelation that the universe is expanding, came from the detection of faint galactic light. So, what's next for light?

[O] Some scientists predict that computing will eventually be based on light. Computer engineers could create devices that, instead of silicon chips, have light beams at their core. Light could even become the main power source for long-distance space travel. The spaceship would have an ultra-thin sail to catch the "wind" of light beamed from an Earth-based laser. In theory, such a craft could accelerate to a sizable fraction of the speed of light - without carrying fuel.

[P] What's certain is that light is going to remain extremely useful - for industry, science, art, and our daily comings and goings. It's an amazing tool, a carrier of beauty, a giver of life. It surely has a very bright future.

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1. Which would be the best alternative title for this passage?
- Light Pollution 101
 - The Power of Light
 - How LiDAR Technology is Changing the World
 - A Day in the Life of a Light Engineer

- _____ 2. What do all the *hundreds of lasers* mentioned in paragraph B have in common?
- a. They are all much smaller than standard lasers.
 - b. All are based on an invention of Townes and Schawlow.
 - c. Every one of them was developed back in the 1950s.
 - d. Each of them was sent to Charles Townes as a gift.
- _____ 3. What is the word *soothing* in paragraph B closest in meaning to?
- a. comforting
 - b. helpful
 - c. damaging
 - d. invisible
- _____ 4. According to the information in paragraphs C and D, an atom emits a photon when its electrons ____.
- a. are in a high-energy, or excited state
 - b. have just begun to "dance"
 - c. change from a high- to low-energy state
 - d. are first struck by a beam of light
- _____ 5. Which of the following takes place first in a laser?
- a. The electrons of the atom get excited.
 - b. Electrons move from a high-energy to a low-energy state.
 - c. Excess energy is released as photons.
 - d. Atoms of a crystal are hit with light.
- _____ 6. What can we infer from the information in paragraph F?
- a. Lasers have solved many problems.
 - b. People still don't know what to do with lasers.
 - c. Kids enjoy playing with lasers, but they are not very useful.
 - d. Lasers cause more problems than they solve.
- _____ 7. Where in paragraph F would the following sentence be the best placed?
- Laser surgery corrects faulty vision in an increasingly routine procedure.*
- a. after the second sentence
 - b. after the third sentence
 - c. after the fourth sentence
 - d. after the fifth sentence
- _____ 8. In the laser at the National Ignition Facility, how many beams of light are contained in each bundle?
- a. 4
 - b. 48
 - c. 192
 - d. 213
- _____ 9. What is the goal of the scientists working on the world's largest laser?
- a. to help design a new military weapon
 - b. to test the strength of various materials
 - c. to develop a new means of space travel
 - d. to produce a new source of energy

- ____ 10. What does *They* refer to in the last sentence of paragraph I?
- electrons
 - photons
 - laser beams
 - children
- ____ 11. Why does the author quote Kathy Szelag in paragraph K?
- to explain a number of exciting new developments in the field of optical networking
 - to show how optical fibers have become more advanced than people expected
 - to challenge the idea that someday one fiber can transmit all the phone calls on Earth
 - to point out there are many advances that can still be made in optical engineering
- ____ 12. What is the best definition of the word *cosmology* in paragraph N?
- a journey through space for the purpose of exploring other worlds
 - the skill of applying cosmetics and beauty treatments
 - the study of the origin and nature of the universe
 - a place that is full of people from many different countries and cultures
- ____ 13. In paragraph O, why does the author place quotation marks around the word *wind*?
- to indicate that the word *wind* is directly quoted from another magazine
 - to emphasize that the wind in the article is actually light, not moving air
 - to show that the author is not sure if this method of propulsion will work
 - to express the author's surprise that wind could be useful for space travel
- ____ 14. In the passage, what is NOT predicted to be an industry that will be based on light?
- space travel
 - computing
 - construction
 - telecommunications
- ____ 15. Which of the following statements is a fact, not an opinion?
- Optical fibers could one day carry millions of channels.
 - Light will play a revolutionary role in communication.
 - Photons have no volume and no charge.
 - In the future, a single fiber will be able to transmit every phone call on Earth.
- ____ 16. What is the author's overall attitude toward the future of light technology?
- cautious
 - neutral
 - pessimistic
 - optimistic

DIRECTIONS: Find the four most appropriate section titles from the list (a–h) and match them to the correct section.

- a. From Martian Heat Rays to Today's Weapon Systems
- b. Light's Impact, Past and Future
- c. Laser Surgery: Hope for the Blind?
- d. Telecommunications at the Speed of Light
- e. Computers That Run on Light
- f. Cheap Green Energy from a Mini-Star
- g. Long Distance Chats with 3D Friends
- h. An Invention That Changed the World

- ___ 17. Section 1 (paragraphs B–F)
- ___ 18. Section 2 (paragraphs G–I)
- ___ 19. Section 3 (paragraphs J–M)
- ___ 20. Section 4 (paragraphs N–P)

DIRECTIONS: Read each sentence. Decide if the use of the underlined word in each sentence makes the statement T (true) or F (false).

- ___ 21. If someone or something dazzles you, you are extremely impressed by their skill, qualities, or beauty.
- ___ 22. If you salvage something, you manage to save it for future use.
- ___ 23. The faculty refers to the teaching staff at a college or university.
- ___ 24. If you alleviate pain or suffering, you make it worse.
- ___ 25. The duration of a concert is how long it lasts.
- ___ 26. A key that has a duplicate is the only one of its kind.
- ___ 27. A companion is someone who you spend time with or who you are traveling with.
- ___ 28. When you confide in someone, you share your secrets with them.
- ___ 29. If you amend something, you change it.
- ___ 30. If you deplete something, you are increasing its amount.

DIRECTIONS: Complete the sentences with the correct form of the words in the box.

compatible	dispute	fake	initiate	liberal
manually	preliminary	rival	sterile	superior

31. The Olympic winner finished the race just a split second ahead of his closest _____.
32. Forged paintings sometimes look so much like the original that it is hard to tell that they are _____.
33. Hospitals have to maintain a(n) _____ environment.
34. The architects submitted the _____ design before the building was approved.
35. The garage door is not automated so it has to be operated _____.
36. The new software is _____ to the old ones because it runs more quickly and efficiently.
37. At the staff meeting, the manager plans to _____ the discussion about pay raises.
38. He has more _____ values, and believes that people should have the freedom to do as they please.
39. At yesterday's trial, the defense attorney _____ the charge that a premeditated murder was committed.
40. They make a good couple; they have many common interests and are very _____.

DIRECTIONS: Match the word or phrase with the definition that best demonstrates its meaning.

- | | |
|---------------|-----------------|
| a. anomaly | f. imitate |
| b. auspicious | g. neural |
| c. commission | h. nostalgia |
| d. deduce | i. organic |
| e. hardship | j. in operation |

- ___ 41. relating to a nerve or to the nervous system
- ___ 42. to copy something as an example or model
- ___ 43. something that is different from what is usual or expected
- ___ 44. relating to living organisms
- ___ 45. a piece of work that is requested and paid for
- ___ 46. to figure out something by reasoning
- ___ 47. an affectionate feeling for the past
- ___ 48. when a new business is actually operating
- ___ 49. to be lucky or favorable
- ___ 50. difficulty or suffering

Reading Explorer 5 Final Answer Section

1.	ANS: B TOP: Final	PTS: 1	REF: Final	OBJ: Main Idea
2.	ANS: B TOP: Final	PTS: 1	REF: Final	OBJ: Supporting Detail
3.	ANS: A TOP: Final	PTS: 1	REF: Final	OBJ: Unfamiliar Vocabulary
4.	ANS: C TOP: Final	PTS: 1	REF: Final	OBJ: Supporting Detail
5.	ANS: D TOP: Final	PTS: 1	REF: Final	OBJ: Sequence
6.	ANS: A TOP: Final	PTS: 1	REF: Final	OBJ: Making Inferences
7.	ANS: D TOP: Final	PTS: 1	REF: Final	OBJ: Cohesion
8.	ANS: C TOP: Final	PTS: 1	REF: Final	OBJ: Supporting Detail
9.	ANS: D TOP: Final	PTS: 1	REF: Final	OBJ: Supporting Detail
10.	ANS: B TOP: Final	PTS: 1	REF: Final	OBJ: Identifying Coherence Devices
11.	ANS: D TOP: Final	PTS: 1	REF: Final	OBJ: Purpose
12.	ANS: C TOP: Final	PTS: 1	REF: Final	OBJ: Unfamiliar Vocabulary
13.	ANS: B TOP: Final	PTS: 1	REF: Final	OBJ: Purpose
14.	ANS: C TOP: Final	PTS: 1	REF: Final	OBJ: Negative Detail
15.	ANS: C Opinion TOP: Final	PTS: 1	REF: Final	OBJ: Distinguishing Fact from
16.	ANS: D TOP: Final	PTS: 1	REF: Final	OBJ: Inferring an Author's Attitude
17.	ANS: H Text TOP: Final	PTS: 1	REF: Final	OBJ: Creating a Mental Map of a
18.	ANS: F Text TOP: Final	PTS: 1	REF: Final	OBJ: Creating a Mental Map of a
19.	ANS: D Text TOP: Final	PTS: 1	REF: Final	OBJ: Creating a Mental Map of a
20.	ANS: B Text TOP: Final	PTS: 1	REF: Final	OBJ: Creating a Mental Map of a

21.	ANS: T TOP: Final	PTS: 1	REF: Unit 7	OBJ: Vocabulary
22.	ANS: T TOP: Final	PTS: 1	REF: Unit 7	OBJ: Vocabulary
23.	ANS: T TOP: Final	PTS: 1	REF: Unit 8	OBJ: Vocabulary
24.	ANS: F TOP: Final	PTS: 1	REF: Unit 9	OBJ: Vocabulary
25.	ANS: T TOP: Final	PTS: 1	REF: Unit 9	OBJ: Vocabulary
26.	ANS: F TOP: Final	PTS: 1	REF: Unit 10	OBJ: Vocabulary
27.	ANS: T TOP: Final	PTS: 1	REF: Unit 10	OBJ: Vocabulary
28.	ANS: T TOP: Final	PTS: 1	REF: Unit 11	OBJ: Vocabulary
29.	ANS: T TOP: Final	PTS: 1	REF: Unit 11	OBJ: Vocabulary
30.	ANS: F TOP: Final	PTS: 1	REF: Unit 12	OBJ: Vocabulary
31.	ANS: rival PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
32.	ANS: fake PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
33.	ANS: sterile PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
34.	ANS: preliminary PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
35.	ANS: manually PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
36.	ANS: superior PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
37.	ANS: initiate PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
38.	ANS: liberal PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
39.	ANS: disputed PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
40.	ANS: compatible PTS: 1	REF: Final	OBJ: Vocabulary	TOP: Final
41.	ANS: G TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
42.	ANS: F TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
43.	ANS: A TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
44.	ANS: I TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary

45.	ANS: C TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
46.	ANS: D TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
47.	ANS: H TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
48.	ANS: J TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
49.	ANS: B TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary
50.	ANS: E TOP: Final	PTS: 1	REF: Final	OBJ: Vocabulary