

Paragraph

- One more familiar use of electrochemistry that has made its way into the mainstream is xerography, a process for replicating documents that is dependent on photoconductive materials. A photoconductive material is an insulator in the dark but becomes a conductor when exposed to bright light. When a photocopy is being made, an image of a document is projected onto the surface of a rotating drum, and bright light causes the photoconductive material to become a conductor. As a result of the conductivity, the drum loses its charge in the lighted areas, and toner (small grains to which dry ink adheres) attaches itself only to the darker parts of the image. The grains are then carried to a sheet of paper and fused with heat. When a laser printer is used, the image is projected onto a drum, which is charged with static electricity, creating a greater contrast between lighter and darker areas and therefore results in sharper printed images.
- Xerography has gone through a series of innovations since its invention in the late 1930s by Chester Carlson. One of the most notable innovations was to the name of the process. When Carlson first developed the technique, he called it "electrophotography" since it used both photography and electrostatic printing in the procedure. Later the name was changed to "xerography" in recognition of the fact that the process reproduces documents using the use of liquid chemicals, instead using a powdered toner to replicate the image.
- A more significant change in the xerographic process occurred when the copier was automated. The production took several steps to complete, and needed creative use of flat plates that were manipulated by hand through the various copying stages. From the beginning, Carlson and others involved with the process realized how inconvenient and time-consuming it was to make a copy, and they worked on ideas to make the process easier. In 1959, just after the original xerographic process was introduced to the public, they devised a suitable solution to the flat plates: a cylindrical rotating surface that allowed the process to be entirely automatic, except for a push of the "start" button.
- The most revolutionary invention of the rotating drum meant the copier was now viable as a commercial product. The first commercial automatic copier, the Xerox 914, came onto the market in 1960. This first generation of copiers was cumbersome by today's standards; not many households would be able to dedicate the necessary space it would take up. In addition, the cost of the copier was high. In order to make the xerographic process and other types of technology have greatly decreased the size of machines capable of making copies. Today, the vast majority of copy machines, as well as many fax machines, make use of Carlson's innovative idea.
- Photocopying through xerography has several steps. First, an electrostatic charge is evenly spread over the surface of the rotating drum, or cylinder. The electrostatic charge is positive or negative depending on what type of copy is being made and what type of copier is being used. Standard copiers generally distribute a positive charge, while digital copiers distribute a negative charge. The toner, which is a dry ink, is exposed to light by flash lamps. At the same time, a combination of lenses and mirrors projects the original image through a lens, so that it is projected onto and synchronized with the rotating drum. The third and fourth step is the transfer of the developed and charged toner to the drum. In the development stage, a form of static electricity propels the powder to coat the image that was projected onto the drum in the previous step. Then, in the transfer step, the toner from the drum, now in the form of the image, is transferred onto paper to be fused with heat. The final step is the separation of the toner from the paper through a blend of pressure on the paper and electrostatic attraction of the toner powder to the paper.

► The remaining steps of the copying process finalize the image onto the paper. After the image has been transferred, the next step is to neutralize the electric charge on the paper and separate the paper from the drum surface. After that, the paper is permanently bonded to the toner, which is where the name "xerography" comes from, which means that the toner particles are permanently affixed to the paper. Finally, any remaining toner on the drum is cleaned off through a process that typically includes some type of suction to remove the particles. Usually, this toner is carried to a container in the machine for later disposal, though some machines will recycle the toner for use in subsequent copies.

1. The author begins the first paragraph with "One more familiar use of electrochemistry" in order to
  - ① explain that xerography is one of the less familiar uses of electrochemistry
  - ② make it clear that electrochemistry requires photoconductive materials
  - ③ show that xerography is the only known use for electrochemistry
  - ④ indicate that other less familiar uses have already been discussed
2. Why does the author explain that "A photoconductive material is an insulator in the dark but becomes a conductor when exposed to bright light?"
  - ① It gives an explanation of a property that is necessary for xerography.
  - ② It indicates that bright light is required for insulation to take place.
  - ③ It gives one example of a successful xerographic process.
  - ④ It explains the role of insulation in xerography.
3. The author mentions "small grains to which dry ink adheres" in order to
  - ① provide information that contradicts the previous statement
  - ② provide an example of conductivity
  - ③ give some further detail information about toner
  - ④ provide an alternate explanation for the effectiveness of toner
4. Why does the author mention "a laser printer" in the passage?
  - ① It is an alternative to xerography.
  - ② It is a way of duplicating without using chemicals.
  - ③ It is a second example of xerography.
  - ④ It is a less effective type of xerography than is a photocopier.
5. Why does the author include the phrase "except for a push of the 'start' button?"
  - ① to explain the one step of the process that Carlson had to invent to overcome
  - ② to indicate that it is not necessary to push a button to begin the copying process
  - ③ to emphasize that improvements to the copying process have reduced the amount of work people had to do
  - ④ to show that Carlson had thought of almost every step necessary in the copying process
6. The author mentions that "not many households would be able to dedicate the necessary space" for a copier in order to
  - ① explain that copiers remain exclusively a product for businesses
  - ② emphasize how large the first automatic copier was
  - ③ illustrate the dislike most households had for copiers when they were first introduced
  - ④ explain how more households have increased in size since 1960
7. Why is "a blend of pressure on the paper and electrostatic attraction of the toner powder" mentioned?
  - ① to summarize the final step of the copying process
  - ② to illustrate how toner is propelled in the development stage
  - ③ to explain how the drum is coated with powder
  - ④ to explain how the image is transferred onto paper
8. Why does the author discuss suction in paragraph 8?
  - ① to provide an explanation of how the last part of the copying process is achieved
  - ② to illustrate the neutralization process
  - ③ to give an example of how toner is recycled
  - ④ to explain how the toner adheres to the paper

Paragraph

- A visitor transported from the early twentieth century to modern times would most likely be amazed by the vast changes in the demographics of the United States over the course of 100 years. The shifts include not only the size of the population and primary residential areas, but more significantly, the shift in the composition of the population, and even the ratio of men to women. All of these shifts have led to the composition of the United States being startlingly different from what it was just a short century ago.

► The United States had already been gradually moving away from being a country of mostly rural areas to a more urbanized society by the latter part of the 1800s. Nonetheless, in the early part of the twentieth century, over 70 percent of the population still lived in farm communities. The census of 1910 documented approximately 20 percent of U.S. citizens living in urban areas while the rest were dwelling in rural areas. However, by the time of the 2000 census, the proportion of people living in urban areas had reversed itself: 80 percent of the population reported living in urban or suburban areas, leaving only 20 percent residing in rural locations.

► Another significant change in the overall U.S. population. According to U.S. census statistics, the population of the United States grew to three times its size over the course of 100 years. In 1900, the official count was 76 million people, while the 2000 census showed a population record of 281 million people, which census people estimate to be accurate. The U.S. census is the only accurate way to count the population in a census. Additionally, based on census statistics, the decade of the 1990s saw the biggest population explosion—32.7 million people—in any 10-year span of the last century.

► An additional shift that may come as a shock to readers is how the United States has aged from 1900 to today. In the beginning of the twentieth century, the median age of the population was under the age of 23. When compared to data from the 2000 census which shows that half of the population in modern times is over the age of 35, a difference of 12 years, a substantial shift in age can be seen. Some of this change has been influenced by improvements in medical technology and the availability of birth control. The median age in the birthrate over the course of the century, "birthing" immediately after World War II, and tapering off again in the last half of the century. In fact, the "baby boom" generation not only impacted birthrates but the 1940s and 1950s were the largest generation in the United States. In both the beginning and middle of the century, the largest age group of U.S. citizens was under the age of 10. In contrast, due to the impact of the baby boom generation, the 2000 census documented that the largest, five-year age groups were over the age of 30: from the age of 35 to the age of 40–44.

► Another shift that a North American from a century ago would not likely have predicted is the change in the ratio of men to women in the United States. At the beginning of the twentieth century, there were more men than women in virtually every state in the United States. However, as the proportion of males to females (measured per 100 birth) steadily declined in every decade from 1910 until 1980, the predominance of men to women reversed itself; by the end of the twentieth century, women outnumbered men in all areas of the United States. According to the 2000 census, the states out of the 50 states had a higher ratio of men to women, with all of those states being located in the western United States.

► One development that may not be considered such a surprise is the change in race demographics, especially since the United States has been described as a nation of immigrants. Although in the first years of the twentieth century, many European settlers to the United States came from Caucasian, or "white" origins, the past century has seen a large influx of other races, including African, Asian, and especially Hispanic (those of Spanish origin or from Spanish-speaking countries) races. As a result, the face of the United States has changed. Whereas only 10 percent of the population in the southern region of the United States claimed a minority population of more than 10 percent in 1900, 26 states recorded a minority proportion of over 10 percent in 2000. In fact, three states, California, Hawaii, and New Mexico, documented a population comprised of more than 50 percent minorities in the 2000 census.

9. The author mentions "A visitor transported from the early twentieth century to modern times" in order to emphasize

- ① how much has changed over the past century
- ② the popularity of the United States for tourists
- ③ that life has not changed much in the United States
- ④ the enormous changes in demographics over the past century

10. The author uses the word "Nonetheless" in paragraph 2 in order to

- ① indicate that many people still lived in rural areas despite a growing shift to city living
- ② emphasize that the rural population was increasing
- ③ point out that there had been a 70 percent rise in the rural population in the late 1800s
- ④ argue that no real change had taken place in rural and urban communities despite census numbers

11. The author includes the phrase "this proportion had reversed itself in part" in an effort to

- ① explain how the population of other had decreased by the end of the 1900s
- ② highlight the continually changing residences of Americans
- ③ reiterate the fact that a majority of the population had moved out of rural areas by the late twentieth century
- ④ to argue that demographic changes were common in 2000

12. "Illegal immigrants" are mentioned in paragraph 3 as an example of

- ① a population that is unlikely to grow
- ② a population that is not always counted on the U.S. census
- ③ a population that accounts for the largest increase of people according to the U.S. census
- ④ a population that usually has no influence on the demographics of the United States

13. Why does the author mention "improvements in health care" in paragraph 4?

- ① It helps to explain why the birthrate is continuing to decline.
- ② It is an example of a factor that contributed to variations in the birthrate.
- ③ It helps to explain why the population is younger today.
- ④ It is an example of a factor that contributed to a rise in the age of the majority population.

14. The author mentions the "baby boom" generation in paragraph 4 because they

- ① change the way the census was conducted in the 1940s
- ② were responsible for a higher percentage of children younger than five years old
- ③ informed us how the total population of the United States aged in the last half of the twentieth century
- ④ had a significant role in the total population aged in the first half of the twentieth century

15. The word "However" is used in paragraph 5 to introduce the concept that

- ② more women than men currently live in the United States
- ③ more men than women currently live in the United States
- ④ women outnumber men in the western part of the United States
- ⑤ women outnumber men in all 50 states

16. The author states "the face of the United States has actually really been changing" in paragraph 6 to emphasize that

- ② the demographic changes in the United States are no longer surprising
- ③ minority populations are increasing in the United States
- ④ the descendants of the first U.S. settlers are now the minority race
- ⑤ minority races make up more than 10 percent of the population in only two states