Questions 1-10

The ballpoint pen is the universal writing instrument of the twentieth century. When the tiny metal ball at the writing tip is drawn across a sheet of paper, it rotates within a housing at the end of an ink reservoir and is coated with ink, which it transfers to the paper.

The first ballpoint pen was invented by John Loud in 1888. Loud has been working on a design for a nonleaking pen to mark leather and fabrics and, although his cumbersome design was similar in essence to the modern item, it was never manufactured in large quantities and the patent was allowed to expire. The first workable design was patented in 1938 and became widely accepted in 1942 when the United States Army required a pen that would not leak in high-flying aircraft.

The ball of the pen is fitted into a socket so that it rotates freely. Several internal ducts in the socket feed ink to the ball; the other end of the socket is fitted onto a metal or plastic tube that contains the ink. When the ball is pressed on paper and moved, the capillary action draws the ink from the reservoir. In effect, the ball functions as a valve to prevent overflow, and on rotation it acts as a suction pump drawing out the ink.

One problem was that as some of the ink ran out, a partial vacuum was formed between the back of the ball and ink reservoir, which cut off the supply. This was solved by making a small hole at the far end of the reservoir. As the ink at the tip is sucked out, more ink from the tube is drawn into the socket to fill its place, the vacuum being prevented by air that is drawn through the vent.

Disposable ballpoints have improved considerably in efficiency and reliability since 1938. Further improvements made recently include the production of a pen that writes at any angle, even upside down, and the development of a new ink that is erasable.

1. The word "it" in line 2 refers to
   (A) paper
   (B) ink reservoir
   (C) writing instrument
   (D) ball

2. The word "housing" in line 3 is closest in meaning to
   (A) point
   (B) residence
   (C) case
   (D) orbit

3. It can be inferred from the passage that there was interest in designing a new type of pen because the old ones
   (A) were too big
   (B) were expensive
   (C) leaked
   (D) cracked

4. The word "expire" in line 8 is closest in meaning to
   (A) end
   (B) change
   (C) copy
   (D) expand

5. It can be inferred that the ballpoint pen first gained popularity among
   (A) military personnel
   (B) businesspeople
   (C) scientists
   (D) artists

6. Which of the following statements is true of the ball in a ballpoint pen?
   (A) It is fitted directly into the tube.
   (B) It controls the flow of ink.
   (C) It has a small hole.
   (D) It contains a reservoir of ink.

7. The author mentions a "suction pump" in line 17 to indicate a function of the
   (A) reservoir
   (B) plastic tube
   (C) socket
   (D) ball

8. The word "which" in line 19 refers to
   (A) supply
   (B) back of the ball
   (C) partial vacuum
   (D) ink reservoir

9. What was the purpose of the small hole mentioned in line 20?
   (A) To drain off excess ink
   (B) To improve ink flow to the tip of the pen
   (C) To reduce the amount of air in the pen
   (D) To allow the reservoir to be refilled

10. Until recently one limitation of ballpoint pens was

(A) their inability to function upside down

(B) the cost of replacing empty reservoirs

(C) the fragility of the point

(D) corrosion due to the ink

Section 3 continues. Turn the page and read the next passage.

Questions 11-20

By the 1920's in the United States, great change had been made in daily life by an accumulation of inventions that had been produced in increasing numbers since the Civil War. These technological innovations created what, in effect, was a social revolution.

Improvements in communications served to knit more closely citizens of diverse ethnic and political backgrounds. Rapid printing presses, typesetting devices, and page-plate processes made printed matter more widely accessible. The telephone simplified person-to-person communication. The phonograph, the silent motion picture, the radio, and the sound picture for the first time made auditory and visual impact simultaneously possible over the whole country and had the inevitable, and perhaps undesirable, effect of establishing a trend to national conformity in thought and feeling. One could call this revolution the nationalization of thought and taste.

Improvements in transportation made all parts of the country less remote from each other when measured by the time required to go from one place to another. Bicycles and trolleys put the nation on wheels. Then the automobile provided the means for speed and mobility, now so dear to Americans, and brought a demand for better highways. By the 1920's cargo trucks were beginning to cut into railroad revenues, and the latest wonder, the airplane, was a fairly common sight.

The transport revolution was made possible by the development and perfection of new engines and motors. The internal-combustion engine, using gasoline or oil, could be built in compact power units admirably suited to automobiles, aircraft, and boats. The use of electricity, generated by water power or coal-burning plants, simplified the problems of mechanical power for industrial use and made electrical illumination commonplace in cities, indoors and out. Electricity also powered an increasing variety of domestic appliances.

11. The passage focuses on the United States in the 1920's primarily in terms of the
(A) creativity of American inventors
(B) decline in social relationships
(C) influence of technology on society
(D) negative side of technological progress

12. The word "knit" in line 5 is closest in meaning to
(A) unite
(B) attract
(C) inform
(D) study

13. The word "accessible" in line 7 is closest in meaning to
(A) understandable
(B) read
(C) printed
(D) available

14. According to the author, expanded communications led to a decrease in
(A) individuality
(B) travel
(C) patriotism
(D) entertainment

15. The words "each other" in line 15 refer to
(A) improvements in transportation
(B) parts of the country
(C) bicycles and trolleys
(D) better highways

16. The word "mobility" in line 17 is closest in meaning to
(A) excitement
(B) movement
(C) modernity
(D) control

17. According to the passage, which of the following modes of transportation was negatively affected by motor vehicles?
(A) Trolleys
(B) Bicycles
(C) Trains
(D) Airplanes

18. The passage suggests that a major advantage of the internal-combustion engine was its
(A) safety
(B) size
(C) durability
(D) price

19. The author identifies all of the following as contributors to the "social revolution" of the 1920's EXCEPT

(A) improved communication
(B) improved transportation
(C) improvements resulting from electricity
(D) improvements in the arts

20. Where in the passage does the author give an example of a technological advance that led to a demand for improvement in another area?

(A) Lines 6-7
(B) Lines 16-17
(C) Lines 21-23
(D) Line 26

Section 3 continues. Turn the page and read the next passage.

Questions 21-30

Astronomers have long used direct photography to gather large amounts of information from telescopes. To do this, they have special light-sensitive coatings on glass plates, whose size depends on the type of telescope employed. Certain wide-field telescopes commonly required very large glass plates. These plates do not bend, can be measured accurately, and can preserve information over a long period of time, providing a record that an astronomer at a later time can examine. However, even though long time exposures increase the amount of light striking the plate so that very faint objects in the sky eventually show up clearly, even the most sensitive plates convert only a small percent of the photons striking them into an image. For this reason, photography cannot make very efficient use of short time exposures on a telescope. Despite this inefficiency, photography is still very useful because it works as a two-dimensional detector covering a large area at a telescope's focus. Hence, the information contained in a single photograph can be enormous, especially when the photograph is taken with wide-field telescopes.

Today, the technology of newer radio and x-ray telescopes has allowed astronomers to view images otherwise invisible to the eye, and direct photography is now used less often to gather images. Today's astronomers can study an enhanced view of a telescope's focus on a television monitor; and in most cases, the data can later be converted by computer into digital form. This procedure, called image processing, plays a central role in astronomy today. Using false colors, the computer can display images of information otherwise undetectable to the unaided eye. These colors are false in the sense that they are not the actual colors of the object in the visual range of the spectrum. Rather, they are codes to a specific property, such as the x-ray emissions from stars.