GENERAL SCIENCE

How Science-Minded Are You?

Take this brief test and find your science talent. The test is a short version of the two-and-one-half-hour Science Aptitude Examination taken by high school seniors in the 20th Annual Science Talent Search.

➤ DO YOU KNOW why the ludicrous looking giraffe has ambled into the laboratory as an important subject of medical research?

Can anybody but a honey bee hear a noise that will stop the bee in his tracks?

How many times 79 is "giga 79"?

If you have some ideas about any of these questions, you may have much more scientific ability than you have been giving yourself credit for.

You can take a quick sample of your potential in a few minutes by choosing the best answer to some interesting questions. They are part of a brief version of the two-and-a-half-hour Science Aptitude Examination given to thousands of high school seniors in December who entered the 20th Science Talent Search for the Westinghouse Science Scholarships and Awards.

For your private testing, allow yourself 20 minutes to complete the sample, then check your answers with those in the answer box on page 78.

If you are astonished and delighted to find that all of your answers are right, you should be. Not one of 150 Science Talent Search contestants selected at random did as well as that.

Give yourself one point for each of your correct answers. A high score on this short version would be at least 13 out of a possible total score of 22. Of the 150 random selections, 41 students did this well or better. A low score would be eight or less. Thirty-four students were down here at the lower end of the totem pole.

The random sample shows that the easiest questions were 32, 91 and C.1. Each of these was answered correctly by 77% or more of the 150 students. Questions 15, 27 and 30 were the hardest with each of these drawing correct answers from only 19% or less of the hopeful test-takers.

The "roughest" question apparently was 15, since only 15% of the students knew what kind of clouds are normal traveling companions for altocumulus castellatus.

The easiest was 32. Nearly everybody, 92%, found it very simple to choose the right answer from the paragraph about Uranus.

If your score does not look very dazzling when you come to compare it to the students', take comfort in knowing that the test is deliberately designed to screen out all but the best among thousands of very able students. No one ever has made a perfect score in the 20 years of the Search.

Dr. Harold A. Edgerton, New York consulting psychologist and chairman of the Science Talent Search judging committee, constructed the 20th Science Aptitude

PART A

DIRECTIONS: Four possible answers are given for each question. Choose that answer which is *most nearly correct.*

13. In experiments to determine how honey bees react to simple sounds, it was found that sound at a frequency of 600 cycles per second at about 120 decibels "stops honey bees in their tracks." They remain "frozen" as long as the sound continues, but return to full activity as soon as the sound is stopped. The sound described is
    1. audible only to insects
    2. lethal to bees if continued for as much as 120 seconds
    3. not audible to human beings
    4. so loud that some form of ear protection is needed for beekeepers hearing it

14. The prefix "giga" is used to indicate a very large quantity. How many times x is "giga"?
    1. 10^{12}
    2. 10^{9}
    3. 10^{6}
    4. 10^{3}

15. With what other cloud form is *altocumulus castellatus* usually associated?
    1. altostratus
    2. cirrocumulus
    3. cumulonimbus
    4. nimbostratus

16. *Cryogenics* is the study of
    1. computer logic
    2. free radicals
    3. the properties of matter under high pressure
    4. the properties of matter at temperatures near absolute zero

17. The giraffe is of interest to medical researchers because of its
    1. excessively high blood pressure
    2. rudimentary vocal cords
    3. susceptibility to certain rare diseases
    4. vitamin deficient diet

26. Which of the following equations is best represented by the graph?
    1. $x + y = a^b$
    2. $y = ax^b$
    3. $ax^2 + by^2 = 0$
    4. $x + y = ab$

27. *Borazon* is another name for
    1. bornite
    2. boron carbide
    3. cubic boron nitride
    4. sodium tetraborate

28. A *Housekeeper seal* is most likely to be found
    1. in a canning factory
    2. in an electric light bulb
    3. in the Pacific Ocean near California
    4. on an official document

29. Recent advances in radio astronomy have been made possible by which of the following?
    1. earth satellites
    2. low frequency radiations
    3. masers
    4. mesons

30. A *coney* is a
    1. geometric figure
    2. mammal
    3. rocky island
    4. species of flightless bird

DIRECTIONS: Four possible answers are given for each question. Choose that answer which is *most nearly correct.*

SECTION A

In the years that ensued, every effort to predict the path of Uranus with accuracy met with failure. Observations revealed that the planet was deviating constantly and systematically from its computed orbit. In 1846, the French mathematician Leverrier showed by means of elaborate equations that this behavior of Uranus was undoubtedly caused by the attraction of another — and as yet unknown planet. He even predicted this seventh body's position in the sky and persuaded the German astronomer Galle to look for it. On the first night of his search, Galle found the planet within a degree of its predicted location.

QUESTIONS ON SECTION A:

31. According to the Section Galle
    1. predicted the unknown planet's position and then found it
    2. found the unknown planet
    3. found Uranus in its predicted position
    4. predicted the unknown planet's position

32. Uranus has a path which
    1. is noticeably affected by its own satellite
    2. has never been predicted with sufficient precision
    3. wandered from its computed path in a constant, yet systematic manner
    4. wandered from its computed orbit erratically and unpredictably

33. Which statement best explains why Leverrier was able to predict the behavior of Uranus where others had failed?
    1. He made use only of observed facts.
    2. He hypothesized the existence of an unknown celestial body.
    3. His predictions were based upon a mathematical model.
    4. The invention of the mechanical computer made his equations useable.

PART B

SECTION Q

The system of mathematical logic consists of basic terms, definition, and postulates followed by theorems deduced from steps preceeding it. There are two possible fates for any proposed theorem: It can be proved from preceeding propositions or it can be proved inconsistent with previously accepted propositions and therefore disproved. There are, however, certain "theorems" that are (or have been) true in every case tried, but are not yet proved. In this category are the "four-color theorem" and Fermat's last theorem. No one doubts that these theorems are true, but no one has been able to prove them.

For years this has been a sore spot with mathematicians, but finally some light may have been shed on the subject. In spite of the two possible classical types of theorems (proved and disproved) it has been proved that a third type exists. This is the class that is true (consistent) but can never possibly be proved. The existence of such a class of theorems was proved by Kurt Gödel in 1931.

Gödel's proof is important because it shows that even in systems of logic designed by man there will be certain truths which cannot be deduced by any logical means. This completely changes virtually every branch of mathematics which has its foundation in any logical thought.

90. Which of the following statements is *least* true?
    1. Gödel's proof has had much effect on most fields of mathematics.
    2. If a statement has been disproved by classical methods, it cannot possibly be consistent with the postulate of the system.
    3. Not all statements true in plane geometry could have been proved by Euclid.
    4. Previously proved statements of Euclidian geometry are put in doubt by Gödel's proof.

91. The existence of the third type of theorem
    1. is shown to be the basis of empiricism
    2. demonstrates the need for experimental procedures
    3. leads to less rigorous mathematical proof
    4. opened new avenues of mathematical investigation

PART C

In each of the following groups of four words or symbols, three belong together because of some characteristic or meaning, while one does not belong with the other three because it lacks the common characteristic or meaning. Choose the one in each group which belongs *least well* with the other three.

1. 1. assimilation
   2. conduction
   3. convection
   4. radiation

2. 1. angle
   2. ångstrom
   3. calorie
   4. decibel

3. 1. monoclinic
   2. monotonic
   3. orthorhombic
   4. triclinic

4. 1. biceps
   2. femur
   3. gastrocnemius
   4. sartorius

5. 1. catenary
   2. circle
   3. derivative
   4. hyperbola

6. 1. kilometer
   2. knot
   3. mile
   4. yard

7. 1. cortisone
   2. insulin
   3. penicillin
   4. thyroxin

For a complete aptitude examination, send 15¢ in coins to Science Clubs of America, 1719 N St., N.W., Washington 6, D. C., and ask for the test.

TEST YOUR SCIENCE TALENT—This is a short version of the two-and-one-half-hour examination for the 20th Annual Science Talent Search.

Examination with Dr. Frederick O. Carleton of New Orleans, La.

As one of the measuring devices of the Search, it is designed to test ability to think and reason in terms of scientific concepts and vocabulary. Most science-minded high school seniors find the examination challenging and enjoyable to take since it is much like the problems, puzzles and games so many of them delight in solving.

Scores on this test represent only the first hurdle in the judging procedures that select the students who seem most likely to become outstanding research scientists. There is no predetermined "passing" grade and scores are plotted on a curve to discover which contestants may be qualified for further judging. The qualifying score for boys in the 20th Search was 75; for girls, 65. This allowed a large margin for further selection, for the highest score among the boys was 111 out of a total possible score of 129. Highest score among the girls, who made up 23% of the entrants, was 104.

Contestants Are Evaluated

As the next step, detailed scholastic records of each "passing" contestant were were evaluated. Then information offered by the student and his faculty sponsor about his accomplishments, activities, traits and attitudes was weighed carefully to find any of a number of good combinations of achievements and promise.

Each entrant is required to submit a written report of an individual research propect. This usually amounts to a thousand or so words of text, plus relevant diagrams, graphs, theorems, pictures, etc. The papers of all the students who survived the first hurdles of the 20th Search were read critically by a board of professional scientists which included specialists in the many fields explored by the student-scientists. This board studied and evaluated reports on everything from an investigation of horse sense to complexes of lead 2,6-dimethyl-4-thiopyrone and the halogens, and computers designed to recognize patterns or compose music.

Then these professional opinions were added to the other evidence for and against each hopeful candidate.

Correlating all of these evaluations, the board of judges selected an Honors Group of 399 students (10% of those with completely qualified entries) who showed outstanding scientific potential. All of these top drawer students are being recommended to colleges and universities for admission and scholarship aid.

To choose 40 top winners from this Honors Group, each detail was reexamined and weighed on an even more precise scale of values. At this point numerical scores had to be combined with subjective judgments based on long experience with, and observation of, potential scientists.

During the Science Talent Institute, to be held March 2 through March 6 in Washington, D. C., the file on each of these 40 will be supplemented by personal interviews. Everything will be weighed again and some very fine hairs may be split to select the five who will be awarded Westinghouse Science Scholarships ranging from $7,500 to $3,000.

In the 20th Science Talent Search 25,355 requests for the examination and other entry materials were received and 3,991 completely qualified entries were judged. Scholastically, 78% of the 93 girls in this year's Honors Group are in the top five percent of their high school classes and at least 41% rank first, second or third. Of the 306 boys, 68% rank in the top five percent of their classes and at least 27% of these are among the top three students.

Some of the traits most characteristic of these promising young people are intense and sustained intellectual curiosity, ingenuity, independence, self-discipline, and an intuitive way of knowing how and why certain theories and facts may fit together. Starting at the sand box age, many of them have investigated an astounding variety of questions.

There is no sameness among this group, except in their interest and ability in science. They are highly individual personalities from every kind of background and with a great assortment of ambitions and motives.

During the Science Talent Institute in March, the 40 winners chosen from this Honors Group will gather in Washington, D. C., for five unique days. In addition to the mutually rewarding experience of learning to know each other, they will meet eminent scientists, visit scientific laboratories of national agencies, and keep their scheduled appointments for interviews with the judges. The Westinghouse scholarships and awards traditionally are announced at the banquet which closes the Institute.

The five scholarships of $7,500, $6,000, $5,000, $4,000 and $3,000, and the 35 awards of $250 each, may be used at any accredited college or university and are intended to assure the professional training of these young pre-scientists. Recognition in the Science Talent Search brings many thousands of dollars in other scholarship offers to the Honors Group. In addition, 37 states and the District of Columbia conduct State Science Talent Searches in cooperation with Science Clubs of America, awarding more than half a million dollars in scholarships to students from their states who were qualified entrants in the national Search.

• Science News Letter, 79:74 February 4, 1961

METEOROLOGY

Weather News Relayed At 850 Words per Minute

➤ WEATHER INFORMATION relayed at the rate of 850 words per minute is now being transmitted by the Federal Aviation Agency using its new Automatic Data Interchange System (ADIS). Both civil and military aviation are being serviced by this first multi-point, high-speed, teletypewriter network.

Operating eight times as fast as most persons talk, the ADIS will speed the collecting of meteorological observations from about 1,000 stations and advance their distribution to 2,500 points of use, operating 24 hours a day, every day of the year.

• Science News Letter, 79:75 February 4, 1961