

GENERAL SCIENCE

Your Science Aptitude

Take this short version of a two-hour Science Aptitude Examination taken by high school seniors in the 22nd Annual Science Talent Search and get some idea of your science talent.

► WITH TALK of shortages of scientists and engineers, you may have wondered whether you have the potential of scientific ability. Here is a test that may give you some insight into qualities you do not know you possess.

For instance, what are canal rays? Is indigo the light sensitive pigment found in all plants, or is it melanin, phytochrome, or rhodopsin? And what about masers?

You can make a quick rough evaluation of your science potential in a few minutes by choosing the best answer to such interesting questions. They are part of the two-hour Science Aptitude Examination given to thousands of high school seniors in the 22nd Science Talent Search for the Westinghouse Science Scholarships and Awards, results of which have been announced.

How to Test Yourself

For your private testing, allow yourself 20 minutes to complete the sample, then check your answers with those in the answer box on page 79.

If you are astonished to find all your answers are right, you should be! None of the Science Talent Search contestants did as well as that!

Awarding yourself one point for each of your correct answers in Parts A and B; and one point for each correct answer in Part C, subtracting one point for each incorrectly marked choice, a high score on this short version would be at least 15 out of a possible total score of 24. A random selection showed 14% of the students did this well or better.

A low score would be five or less, scored by about 10% of the students. The easiest questions were 16, 19, 40, 79, 80 and 81. Each of these was answered correctly by 71% or more of the 200 students. Questions 9, 15, 17 and 18 were the hardest, with each of these drawing correct answers from only 25% or less of the hopeful students.

The most difficult question was 17, with only 17% of the test-takers knowing that *Zinjanthropus boisei* was used in estimating that 1,750,000 years ago.

On the other hand, 78% of the contestants knew that a nucleus is part of one or another bacterial cell, one of the correct answers to question 80.

If your score is not very impressive when compared to the success made by science-oriented students, take comfort. The test is deliberately designed to screen out all but the best among thousands of very able students. None has made a perfect score in the entire 22 years of the Science Talent Search.

Dr. Harold A. Edgerton, Washington psychologist, constructed the 22nd Science

PART A

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

- A thanatocoenose is
 - an assemblage of dead plants and animals
 - an extinct reptile
 - a preserving fluid
 - used in the study of protozoans
- The light sensitive pigment found in all plants is
 - indigo
 - melanin
 - phytochrome
 - rhodopsin
- Canal rays are
 - directed beams of light
 - positive particles issuing from a perforated cathode
 - topographical features of Mars
 - related to sharks
- Which of the following was the nation's number one cause of death in 1960?
 - accidents
 - cancer
 - heart disease
 - pneumonia
- An amphiprotic substance would be
 - HSO_4^-
 - NH_3
 - NaCl
 - NaOH
- The liquid hydrogen bubble chamber was developed by
 - Donald Glaser
 - Edward Purcell
 - William Shockley
 - C. C. Wilson
- Maser principles would most likely be discussed in an article on
 - genetics
 - long distance communications
 - psychology
 - zoology
- Zinjanthropus boisei* has been estimated to have lived 1,750,000 years ago. By what dating method was this estimate made?
 - carbon-14
 - neon-sodium
 - nitrogen-krypton
 - potassium-argon
- High purity beryllium relative to ordinary beryllium is more
 - brittle
 - chemically active
 - dense
 - ductile
- The key to heredity appears to be in
 - amino acids
 - cell nuclei
 - molecules of deoxyribonucleic acid
 - protein content of cells

SECTION D

The differential chain block, shown in the diagram, consists of two sheaves, A and B, A being double sheave having diameters R and r . The multiplying power of this mechanism depends upon the ratio of these diameters. If they are equal, the pull P will not move the weight, and the efficiency of the mechanism will be zero percent, but the theoretical mechanical advantage is infinity. A slight difference in radii will produce a very large lifting effort, although the efficiency may still be very low. The sheaves are made with link pockets so that the chain fits nicely into the circumference, and is restrained from slipping. Furthermore, the chain is endless, and the mechanism is self-locking by virtue of the friction intentionally allowed on the journals.

In explanation of the chain block, if the pull P revolves sheave A one revolution, the vertical chain at a is lowered through a distance of $2\pi r$, while the side b is raised the distance $2\pi R$. The net vertical displacement of the sheave B is $\pi(R-r)$ upward. With no friction considered, the work of lifting W through this distance must be equal to the work done by the pull P moving through $2\pi R$. Solving this equation for advantage $\frac{W}{P}$,

$$\frac{W}{P} = \frac{2R}{R-r}$$

Applying the mechanical efficiency e to this equation, the actual mechanical advantage is

$$\frac{W}{P} = \frac{2Re}{R-r}$$

These chain blocks are built in different sizes for hoisting loads from one-quarter ton to three or four tons, by hand. On account of the self-locking feature depending on friction, the average mechanical efficiency of this device is only about 30%.

QUESTIONS ON SECTION D

- Which of the following statements is true? When the pull P revolves sheave A two revolutions, and sheaves A and B have the same diameter, then
 - if $R = r$, sheave B can only rotate in place
 - if $R > r$, sheave B will be lowered
 - if $R < r$, sheave B will be raised
 - for any values of R and r , sheave B will be neither lowered nor raised
- The multiplying power of the mechanism is
 - a function of the ratio of R and r
 - limited by the amount of pull a man can exert
 - lowered by the amount of friction present
 - the same as the mechanical advantage
- As sheave B is raised through the use of the mechanism
 - the chain loop of P will become larger
 - the chain loop of P will become smaller
 - the chain loop of P will remain the same size

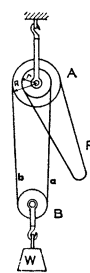
DIRECTIONS: READ these directions carefully. Each question has four possible answers, BUT there may be as many as FOUR right answers for a question. For some questions there will be only one right answer, while others may have two, three or four right answers.

PART C

- Niobium is
 - a metal
 - an element
 - an opiate
 - a rare earth

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PART B



- no information is available to show relationship of length of the chain loop of P and travel of sheave B

SECTION H

Pair formation in the geese (*Anser*, *Branta* and related genera) takes place under different circumstances and the result is an entirely different species structure. Geese are among the very few birds in which the family does not break up at the end of the breeding season, but parents and young stay together for nearly a year. They migrate together to the winter quarters, they spend the entire winter together, and they do not separate until after the return to their nesting area. This closeness of the family system, together with their colonial or semi-colonial breeding habits, guarantees the closest kind of inbreeding. No other sub-Arctic or Arctic bird breaks up into so many pronounced races as the geese. The Canada geese of the genus *Branta* have some six to nine geographic races in North America, some of which are so different that some authors propose to put them in three or four different species. On Southampton Island, Sutton (1932) found at least two forms; a larger one (*Leucopareta parvipes*) inland on streams, and a smaller one (*hutchinsii*) on islands in the shallow coastal lakes. The inland form arrives earlier in the spring and builds a large moundlike nest; the coastal species starts nesting later in the season and lays its eggs in a depression of the ground. The two forms are exceedingly similar, except for the small difference in size, but habits have produced a degree of reproductive isolation which may be of specific rank. The very peculiar taxonomic condition of these geese, e.g., the geographic proximity of strikingly different forms in the absence of geographic barriers or of intergrading populations, can be explained only on the basis of internal factors.

QUESTIONS ON SECTION H

- According to the paragraph, *Branta canadensis leucopareta parvipes* differs from *B.c. hutchinsii* mainly in
 - migration routes
 - nesting habits
 - social behavior
 - size
- Which phrase best describes the North American population of *Anser*, *Branta*?
 - completely homogeneous
 - distinctly separated geographical races
 - geographic variation with much intergradation
 - marked sexual dimorphism
- The condition which would tend to have an effect on a species similar to that of breeding and social habits of geese is
 - a high mortality rate among nestlings
 - geographic separation of breeding populations
 - interbreeding between individuals from different parts of the species range
 - variation of diet with locality
- Which statement can best be inferred on the basis of the materials in the paragraphs?
 - Geese are monogamous.
 - Geese identify their own flock by sound.
 - Goslings are trained by the parent rather than the flock.
 - Pairing of mates is commonly within families which had wintered together.

- Which of the following have been found to be parts of one or another bacterial cell?
 - a nucleus
 - centrosome
 - slime layer
 - sulfur particles

- A star's color indicates its temperature. In this case
 - blue giant stars are hottest
 - dimnest stars are farthest away
 - red stars are the coolest
 - yellow stars are hottest

TEST YOURSELF—Compare your score with those of a random sampling of the thousands of high school seniors who took the full test.

Aptitude Examination. He also is chairman of the Science Talent Search judging committee.

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 one part in the judging procedures that select the students who seem most likely to become outstanding research scientists. There is no predetermined "passing" grade.

Detailed scholastic records of each "passing" contestant were evaluated. 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 achievement and promise.

Research Report Required

Each entrant was required to submit a written report of an individual research project, usually about a thousand words of text, plus relevant diagrams, graphs, theorems, pictures, etc.

The papers of all the students 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 computer methods, viruses, planet observations, lasers, complex mathematics, microorganisms and more than a thousand other subjects.

Correlating all of these evaluations, the board of judges selected an Honors Group of 327 students (10% of those with completely qualified entries). These students are being recommended to colleges and universities for admission and scholarship aid.

The Science Talent Search is supported by the Westinghouse Educational Foundation and is administered by SCIENCE SERVICE through its Science Clubs of America.

In the 22nd Science Talent Search, 22,477 sets of examination materials were requested. There were 3,274 completely qualified entries judged.

The 40 top winners from the Honors Group were selected to attend the Science Talent Institute, Feb. 27 through March 4, in Washington. Each will have interviews with the board of judges for the Westinghouse Science Scholarships and awards.

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, 41 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.

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.

• Science News Letter, 83:74 February 2, 1963

TECHNOLOGY

New NBS Facility for Better Time Broadcasts

See Front Cover

► THE GLOBAL network of missile and satellite stations will be better coordinated with the construction of the new facility for improved standard frequency and time broadcasts by the National Bureau of Standards.

On a carefully chosen site near Fort Collins, Colo., 400-foot antennas are being erected and 50-kilowatt transmitters are being built to increase the coverage of the standard frequency and time transmissions of NBS stations WWVB (60 kc/s) and WWVL (20 kc/s).

Seen on this week's front cover is a table model of the diamond-shaped antennas of the new facility. Each antenna will be about 900 feet long and 750 feet wide and will be supported by four 400-foot guyed masts.

Both WWVB and WWVL have been transmitting for several years from sites near the Boulder (Colo.) Laboratories of NBS and the high stability and long-range coverage of the lower frequencies have been established.

Low frequency transmissions follow the curvature of the earth and are not affected by the ionosphere which serves only as the upper boundary, not a reflector, for the signals. However, high frequency transmissions bounce between the earth and the ionosphere and are affected by the variations of the ionosphere.

With the new antennas and transmitters, the radiated power of WWVL will be increased to one kilowatt and of WWVB from two watts to seven kilowatts.

Signals from both these stations will be compared continuously with the U.S. frequency standard which is provided by atomic clocks at the NBS Radio Standards Laboratory.

Strong support is being given to this program by the National Aeronautics and Space Administration.

• Science News Letter, 83:75 February 2, 1963

TECHNOLOGY

Computer Tells Parts of Speech Faster Than Man

► A COMPUTER will be able to pick the subject and predicate of a sentence faster than a human being can read it. A computer program has been developed at the University of Wisconsin to parse written material at a speed of 1,380 words per minute with an accuracy of more than 90%.

• Science News Letter, 83:75 February 2, 1963

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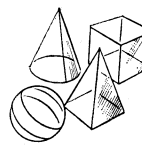


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PUBLIC HEALTH

Early Care, Counseling Vital to Hemophiliacs

➤ **SEVERE** physical and social crippling of hemophiliacs might be prevented through early care and counseling.

These are the conclusions of a two-year study of social and vocational problems of 1,100 hemophiliac adults, carried out by Dr. Alfred H. Katz, Jacqueline MacAfee and Florence B. Goldy of the School of Public Health at the University of California, Los Angeles.

Hemophilia is a hereditary disorder characterized by inability of the blood to clot. Any slight injury may lead to a severe, possibly fatal hemorrhage. More than half of those surveyed reported from two to 20 major hemorrhages yearly prior to age 16. Crippling arthritic effects frequently occur.

Despite such handicaps, more than 70% of the hemophiliacs surveyed are living normally, vocationally and socially. More than half are employed, and about 40% are married. Thirty percent of the married group have children. More than 3% were severely disabled.

The investigators recommended that hemophiliacs be counseled and trained for jobs suitable to their capacity, but not at the risk of social isolation.

Watch repairing, usually carried on in near-seclusion and a very confined space, is apparently a favorite job recommendation for hemophiliacs. Such an occupation is physically and psychologically bad for them, compounding problems of social isolation.

• Science News Letter, 83:79 February 2, 1963

TECHNOLOGY

Infrared Radiation Used as New Analyzer

➤ **INFRARED** radiation is now being used to inspect heat insulation and electrical and gas heating equipment. The method is less expensive and gives analysts information unavailable with more costly operations and equipment. With the technique a complete picture of heat distribution on photographic film can be obtained. A number of products can be improved, design analysts predict. These include high-pressure boilers, electric motors, internal combustion machines, refrigerators and trailers.

• Science News Letter, 83:79 February 2, 1963

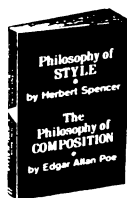
Science Exam Answers

To check yourself on the Exam, p. 74, score one point for each correct answer in Parts A and B, and one point for each correct answer in Part C while subtracting a point for each incorrectly marked answer in Part C.

PART A: 5-1; 6-3; 7-2; 8-3; 9-1; 15-1; 16-2; 17-4; 18-4; 19-3.

PART B: Section D-38-1; 39-1; 40-1. Section H-53-2; 54-2; 55-2; 56-4.

PART C: 79-1, 2; 80-1, 3, 4; 81-1, 3.



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