

## GENERAL SCIENCE

# Test Your Science Aptitude

Determine your science potential with this short version of the two-hour Science Aptitude Examination taken by high school seniors in the 24th annual Science Talent Search.

► MANY OF US wonder how we compare with today's up-and-coming high school scientists. Here is a test that may give some such indication. It may be less embarrassing to take the test in private. The questions are not easy.

For instance, what is imprinting? Did you ever hear of angstroms? The question tells us that technetium is an element, which we might have guessed, but the details we are expected to answer are more difficult.

These are but a few of the questions in the two-hour Science Aptitude Examination given to thousands of high school seniors in the 24th Science Talent Search for the Westinghouse Science Scholarships and Awards, results of which were recently announced.

The students taking the test have already found many such topics a fascinating area of study and experimentation. The constant thirst for knowledge is an important trait in the making of a future research scientist.

Take the test first, to gauge your own science aptitude, and pursue all the interesting avenues of study later.

Allow yourself 20 minutes to complete the sample, then check your answers with those in the answer box on p. 126. Some questions have more than one answer. Each answer must be entirely correct to qualify as correct.

A high score on this short version would be at least six out of a possible total score of 16. A random selection showed 17% of the students did this well or better. A score of one or zero was attained by 16%, so if you completely blanked out on the short version, you were not alone. However, none of the students failed to score in the two-hour version.

The easiest question was 55, answered correctly by 57% of the students. Other questions answered correctly by 25% or more of the students were 28, 31, 54, 56, 63 and 64.

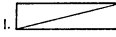
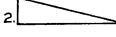



The most difficult questions were 30, 37 and 57. Each of these brain teasers stumped over 90% of the random sample.

If you find the random sample of hopeful students scored low, and you are disappointed with your own showing, you should know that this was the purpose of the test. It was deliberately designed to screen out all but the best among thousands of very able science-oriented students. No one has made a perfect score in the entire 24 years of the Science Talent Search. The highest score on the short version was attained by a boy in the random sample who answered 12 of the 16 questions correctly. Another boy, and the top girl in the sample scored 11. The sample consisted of 203 boys and 99 girls.

Dr. Harold A. Edgerton, Washington  
(Continued on p. 126)

## PART A

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

- It is known that a chick or bird will choose another strange creature or object in preference to its real parent during a critical period, if given the chance to identify the thing as its "mother" first. So geese, for example, have been known to prefer a passing boat to their own mother. This sort of phenomenon is called
  - adaptation
  - imitation
  - imprinting
  - instinct
  - transference
- Wavelengths of 5000 angstroms belong to the
  - greens
  - infrarreds
  - purples
  - ultraviolets
  - yellows
- The element *technetium* (atomic number 43) is
  - a basophilic element
  - associated with copper-bearing ores
  - found only in the sun's spectrum
  - classed as a rare earth
  - produced by artificial radioactivity
- The observed red shift in the spectra of distant galaxies
  - is used to measure the speed with which they are receding from the earth
  - is a result of increased red H $\alpha$  emission
  - is a visual illusion
  - has been noted only for the hotter groups of stars
  - is used as a measure of their distances
- Which of the following compounds is (are) found in deoxyribonucleic acid?
  - adenine
  - glycine
  - guanine
  - uracil
  - uracil
- Which of the following is (are) classed as isoperimetric figure(s)?
  - 
  - 
  - 
  - 
  - 
- Acromegaly*
  - may be associated with gigantism.
  - is accompanied by impaired vision
  - is a form of dwarfism
  - is a result of overactivity or a tumor of certain cells of the pituitary gland
  - produces sexual maturity at unusually early ages
- Genetic mapping is used to study
  - eugenics
  - geographic distribution of a gene pool
  - hereditary patterns
  - the fine structure of the nucleus
  - the composition of DNA

## PART B

**DIRECTIONS:** In Part B, the questions and answers following each section are based on the information given. Each question has five possible answers, BUT there may be as many as five right answers for a question. For some questions there will be only one right answer, while others may have two, three, four or five right answers.

### SECTION D

Liquid helium undergoes a change in its physical properties at 2.189° K, the so-called lambda-point. The form stable between the critical temperature and the lambda-point is called liquid helium I, and that stable between the lambda-point and absolute zero is called liquid helium II. Since the transformation is one of higher order, without latent heat at the lambda-point, the two liquid forms are never co-existent. The lambda-transformation does not occur in liquid helium with the isotopic weight 3. Liquid helium is a remarkable substance as, owing to its high zero-point energy, it has a very low density and will not solidify under its own saturation pressure. Even near absolute zero, an external pressure of about 25 atmospheres is required for solidification. The density has a maximum at the lambda-point. Whereas helium I has, apart from its low density, most of the properties of a normal liquid, helium II shows a very anomalous behavior. Its viscosity is vanishingly small, and its heat conductivity is much higher than that of any other substance. Moreover, there exists a thermomechanical ("fountain") effect. If two vessels containing helium II are connected by a narrow capillary and heat is supplied to one of them, a flow of helium in the direction of the higher temperature will take place. Conversely, in the mechano-caloric effect, a forced flow of helium II through a capillary will result in a cooling of the liquid leaving the capillary. Also, pulses of heat created in the liquid will be propagated in it similarly to density pulses in sound, and the phenomenon has therefore been called second sound. Solid surfaces in contact with liquid helium II are covered with a film of 50 to 100 atoms thickness, along which frictionless flow of liquid can occur. Mass transport through the helium II film takes place at a constant rate which only depends on temperature. It has been shown that in film transport below this critical rate, the flow of mass is completely free of friction.

### QUESTIONS ON SECTION D

- The critical temperature of liquid helium is
  - equal to the lambda-point plus latent heat
  - higher than the lambda-point
  - a mechano-caloric phenomenon
  - not present in liquid helium of isotopic weight 3
  - the lowest temperature at which helium is a liquid
- Liquid helium will NOT solidify
  - if it is helium I
  - if it is helium II
  - if it is helium 3
  - unless it is subjected to external pressure
  - while it is superconductive
- The so-called lambda-transformation
  - has a thickness of 50 to 100 atoms
  - is not a freezing point for liquid helium II
  - marks the temperature boundary between helium I and helium II
  - takes place at 2.189° K
  - takes place at the critical temperature

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- Which of the following statements regarding the behavior of helium are true?
  - Helium I has a greater density than helium II.
  - Helium II has less viscosity than helium I.
  - Helium 3 behaves like a normal liquid.
  - Helium 3 is a poorer heat conductor than helium II.
  - Helium 3 has a maximum density at the lambda-point.

### SECTION F

A recent hypothesis has proposed that the thymus is involved in the establishment of a lymphoid population in the early development of the spleen. This theory is of importance not only in relation to histogenesis, but also in terms of the role played by the thymus in immunity. It was proposed that there should be certain observable interaction between thymus and spleen *in vitro* and that spleen alone would not become lymphoid. Thymus explants from 12-day embryos of the mouse when placed in culture conditions became lymphoid within seven days. At this time there was a diverse lymphoid cell population interspersed with connective tissue elements. Spleen fragments from embryos of the same age failed to become lymphoid. However, when spleen and thymus were explanted in the same chamber, follicular structures surrounding the tissue mass were formed. Also such conjoint cultures retained the lymphoid state for longer periods of time than the thymic controls. When thymus was explanted in the presence of mesenchyme from lung, limb or salivary gland, no synergism appeared. Spleen injected into mouse eyes pretreated with radiation to eliminate their lymphocytes failed to differentiate a lymphoid system.

### QUESTIONS ON SECTION F

- The results of these *in vitro* experiments support the hypothesis that the thymus
  - has an embryological role in the immunological system
  - is a degenerating organ
  - controls the spleen throughout life
  - is the major immunological organ of the mammalian organism
  - controls the lymphoid system
- Which of the following methods was not used to further support the theory of a selective synergism?
  - spleen in the eye of the mouse
  - thymus with salivary gland
  - thymus with lung
  - spleen with mesenchyme of limb
  - thymus in the eye of a mouse
- The results lead to the conclusion that the
  - spleen becomes lymphoid in the absence of the thymus
  - thymus gives rise to the entire lymphatic system
  - thymus "seeds" the spleen with lymph elements
  - thymus has an important role in endocrine secretions
  - thymus plays a decreasing role

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

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## Your Science Aptitude

(Continued from p. 118)

psychologist, constructed the 24th Science Aptitude Examination. He also is chairman of the Science Talent Search judging committee.

There is no predetermined "passing" grade. As one of the measuring devices of the Search, the examination is designed to test ability to think and reason in terms of scientific concepts and vocabulary. Scores on this test represent only a part in the judging procedures that select the students who seem most likely to become outstanding research scientists.

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.

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 300 students (just over 10% of those with completely qualified entries). These students are being specifically recommended to colleges and universities for admission and scholarship aid, while a list of all students completing entries has been sent to colleges and universities for their consideration.

The 40 top winners from the Honors Group were selected to attend the Science

Talent Institute, Feb. 24 through March 1, in Washington, D. C. Each will have interviews with the board of judges and five will be given Westinghouse Science Scholarships ranging from \$7,500 to \$3,000 and the rest awarded \$250 each.

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 24th Science Talent Search, 22,692 sets of examination materials were requested. There were 2,939 completely qualified entries judged.

The Science Talent Institute in Washington will provide a unique five days. In addition to the mutually rewarding experience of learning to know each other, the 40 winners 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 scholarships and awards 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, 42 states and the District of Columbia conduct State Science Talent Searches in cooperation with Science Clubs of America, awarding more than a half million dollars in scholarships to students from their states who were qualified entrants in the national Search.

### Science Aptitude Exam Answers

To check yourself, score one point for each entirely correct answer.

PART A: 4—3; 5—1; 27—5; 28—1, 5; 29—1, 3; 30—2, 4; 31—1, 4; 37—5.

PART B: 54—2; 55—4; 56—2, 3, 4; 57—2, 4; 58—1, 3, 4; 62—1; 63—4, 5; 64—3.

For a complete aptitude examination, send 15¢ in coins to Science Clubs of America, 1719 N St., N. W., Washington, D.C. 20036 and ask for the test. Or send one dollar for eight different tests, which will include this year's examination.

• Science News Letter, 87:118 February 20, 1965

## Do You Know?

*Parkinson's disease* takes more than 2,800 lives a year in the United States, with about 40,000 new cases occurring annually.

The satellite Relay I, launched December 1962, has transmitted *encephalograms* from England to the United States for medical diagnosis.

*Aequorin*, a protein found in jellyfish, glows in the presence of calcium.

• Science News Letter, 87:126 February 20, 1965

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