GENERAL SCIENCE

How Is Your Science Ability?

This short version of an examination given to high school seniors is the first step toward being judged among the nation's top young scientists.

By SHIRLEY MOORE

➤ MODERN SCIENCE advances so fast that most adults are running a slightly befogged and breathless race to catch current knowledge by the coat-tails.

But in this year of sputnik, atomic power and demands for more and better research scientists, more than one thousand high school seniors have shown they have a very firm hold on science's coat-tails. They know enough about experimental method and scientific reasoning and show enough scientific ability to pass the Science Aptitude Examination, successfully placing as Candidates in this year's Science Talent Search.

Could you? To give you a clue to your possible ability, some sample questions are presented from the intensive and difficult examination taken by boys and girls who participated in the Search. The examination is intended to pass only the best and no one has ever made a perfect score in the 2½ hour test. It is especially designed for the Science Talent Search conducted each year by SCIENCE SERVICE through its Science Clubs of America and supported by the Westinghouse Educational Foundation.

This is the 17th of these Searches that have been discovering hundreds of unusually talented young people who have gone on to successful college training and outstanding careers in science. A total of 25,039 requests for the examination were received, an increase of 25%, and the largest number of completely qualified entries, 4,050, were judged.

The aptitude test is only the first step in finding the talented high school seniors the Search is designed to discover and help. Judges go on to evaluate each Candidate's school record, his or her faculty recommendations, and a 1,000-word report on a research project. On the basis of these evaluations, the 40 winners and 260 honorable mentions are chosen.

The judges are Dr. Harold A. Edgerton, Richardson, Bellows, Henry and Co., New York; Dr. Steuart Henderson Britt, Northwestern University; and Dr. Rex A. Buxton, Washington, D. C., psychiatrist.

The top 40 winners are given a trip to Washington for the five-day Science Talent Institute where they meet eminent scientists, visit scientific laboratories of unusual interest, and are interviewed by the judges. An awards banquet climaxes the Institute with the announcement of the winners of $34,250, triple previous amounts, in Westinghouse Science Scholarships and Awards.

Five scholarships ranging from $7,500 to $3,000 and 35 awards of $250 may be used at any accredited college or university. They help to assure these promising young scien-

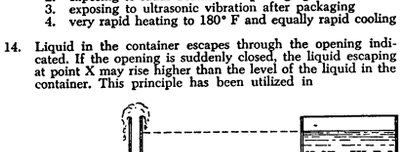
PART A

DIRECTIONS: Four possible answers are given for each question. Choose that answer which is *most nearly correct*. Record your answer by putting an X in the answer box corresponding to your chosen answer.

12. Which of the following is *not* caused by a virus?
    1. influenza
    2. malaria
    3. psittacosis
    4. smallpox

13. What new treatment makes mixed salad greens stay fresh twice as long in the markets as they did without the treatment?
    1. dipping in a solution of terramycin or streptomycin before packaging
    2. exposing to radar beams after packaging
    3. exposing to ultrasonic vibration after packaging
    4. very rapid heating to 180° F and equally rapid cooling

14. Liquid in the container escapes through the opening indicated. If the opening is suddenly closed, the liquid escaping at point X may rise higher than the level of the liquid in the container. This principle has been utilized in



    1. fire-fighting apparatus
    2. hydraulic rams
    3. lawn sprinklers
    4. siphons

15. Which of the following does *not* belong to the "rare earth" family?
    1. androecium
    2. lutetium
    3. praseodymium
    4. ytterbium

35. Which of the following is *not* typically an aromatic substance?
    1. naphthalene
    2. phenol
    3. picric acid
    4. quinone

36. "R_F values" would most probably be useful to which of the following?
    1. aeronautical engineer
    2. electrical engineer
    3. organic chemist
    4. psychologist

37. There is evidence that when a nuclear particle of a certain type meets its opposite number, the proton, the resulting explosion turns the particles into "bursts of energy." The nuclear particle referred to is
    1. a meson
    2. a positron
    3. an anti-proton
    4. an electron

38. Which of the following is *not* a disease caused by hyposecretion of an endocrine gland?
    1. Addison's disease
    2. exophthalmic goiter
    3. myxedema
    4. tetany

PART B

DIRECTIONS: Four possible answers are given for each question. Choose that answer which is *most nearly correct*. Record your answer by putting an X in the answer box corresponding to your chosen answer.

SECTION C

The six faces of a cube are marked a, b, c, d, e, f. Side a is opposite side d, b opposite e, and c opposite f. The letters representing the faces are arranged in the following matrix (simply a rectangular array):

a	b	c
d	e	f

Suppose the orientation of the cube in space is changed in such a way that, after the change in orientation, the faces of the cube are parallel to the faces of the cube before the change of orientation. The change will, with center fixed, cause each face to take the position formerly occupied by some other face. This change will affect the matrix. For example: If the cube is reoriented so that face b is where face e was, c where f was, and a and d retain their positions, the matrix becomes:

a	e	f
d	b	c

It is seen that any orientation of a cube that satisfies the conditions stated above is characterized by its matrix. It is also evident that any change in orientation of a cube can be considered as being compounded of successive 90° rotations about lines perpendicular to the faces of the cube.

QUESTIONS ON SECTION C

48. A cube is reoriented so that face a is where face e was, and e where d was. Face c is now where face . . . . was. What is the missing letter in the preceding sentence?
    1. b
    2. c
    3. d
    4. f

49. The orientation matrix of a cube is:

a	b	c
d	e	f

The cube is first rotated 180° around a line perpendicular to faces c and f. It is then rotated 90° around a line perpendicular to faces c and f. Which matrix represents a possible orientation of the cube?

1. | a | d | c |
   | e | b | f |
2. | b | a | f |
   | e | d | c |
3. | e | a | c |
   | b | d | f |
4. | e | d | c |
   | b | a | f |

SECTION R

Growth is an essential part of life; it is the process by which a living organism reproduces, enlarges, and matures. This coordinated development of plant tissues occurs primarily in specific regions of the plant body called meristems where cells retain their power to divide and to enlarge. A meristem is also described as "undifferentiated embryonic tissue exhibiting juvenile characteristics in contrast with the differential or mature tissues that arise from it." There are three principal meristems of a vascular plant: apical stem meristems, apical root meristems, and cambium, each of which is highly reproductive. At every center of growth and cell reproduction there is an apical cell or initial cell which initiates and perpetuates the growth of the plant from that particular center. These centers are also regions of intense respiratory activity which results in various dynamic and metabolic processes which are integral phases of growth. Plant nutrition also involves the assimilation of water, soluble foods, protoplasmic proteins, cellulose, minerals, and other nutrients within an actively growing meristem in a process which manufactures new cell tissue and protoplasm.

QUESTIONS ON SECTION R

93. The chief function of meristems is
    1. assimilation
    2. cell maturation
    3. cell reproduction
    4. not indicated in the paragraph

94. The number of apical meristems in a given plant is
    1. dependent upon the nutrition of the plant
    2. equal to the number of roots, stems, and buds
    3. not given in the paragraph
    4. relative to the size of the plant

95. Which one of the following has *least* influence on plant growth?
    1. Respiratory activity which results in the oxidation of carbohydrates in the maturation phase of growth.
    2. The construction of new cell walls and protoplasm from foods.
    3. The proportionate relationship between cambium (lateral meristems) and apical meristems.
    4. The translocation of essential water and nutrients to growing parts of the plant.

TEST YOURSELF—This is a short version of a 2½-hour examination for the 17th Annual Science Talent Search. Try it and then compare your score with those of a random sampling of the more than 25,000 high school seniors who took the full test and answered the same questions.

PART C

102. Each item in Column I (see answer sheet) is a discovery, theory, or development. In Column II are the names of some scientists. Place the number of the name of the scientist from Column II in the parentheses before the discovery, theory, or development in Column I with which he is the *most* closely associated.

COLUMN II		Column I
1. Bohr	( )	1. Atomic model
2. Fraunhofer	( )	2. Corpuscular theory of light
3. Herschel	( )	3. Electromagnetic theory
4. Huygens	( )	4. Quantum of light
5. Kirchoff		
6. Maxwell		
7. Michelson		
8. Newton		
9. Planck		

104. Each item in Column I (see answer sheet) is the name of a device. Column II contains the names of branches of science and technology. For each item in Column I, put the number in the parentheses of the branch of science or technology (from Column II) in which it is commonly used.

COLUMN II	Column I	
1. astronomy	( )	1. anemometer
2. botany	( )	2. electroencephalograph
3. broadcasting	( )	3. interferometer
4. geology	( )	4. psychrometer
5. mathematics	( )	5. spectroheliograph
6. meteorology		
7. optics		
8. psychology		

tists of college training in their fields. In addition, recognition in the Science Talent Search brings each year's top 40 and honorable mentions thousands of dollars in other scholarship offers.

With this background, are you ready to find out how much unsuspected ability you may have in science? Allow yourself 30 minutes to complete this shortened version of the aptitude test. Then check your answers with those given on p. 46.

On the full-length examination the score which admitted a contestant to the group of 1,074 Candidates was 136 for boys, 113 for girls. Top score for all boys was 212. Top score for all girls was 204, and girls made up 21% of the contestants. These scores were weighted.

If you find you have answered all the questions in the sample correctly, you fared better than any of the 125 contestants selected at random.

A high score on the short version would be 12 for boys, 9 for girls. Of the 125 random selections, 24 students did this well or better. A low score would be 5 or less. Twenty-seven students did this poorly.

Based on the results of the 125 tests, the easiest questions were 12, 93, 95, and 104-5. Each of these was answered correctly by more than 50% of the 125 students. Questions 38, 102-2, and 104-4 were the hardest, with 20% or less of the students getting them right.

The most difficult question was 104-4, which was answered correctly by only 11% of the students, and the easiest, 104-5, answered correctly by 76% of the 125.

You should not feel inferior if your score makes a pretty poor showing in comparison with those of the unusually able high school seniors. The test has been made sufficiently difficult, say the psychologists who devised the test, to measure aptitude for becoming a successful research scientist. Although only a very small percentage of people have the ability to become the scientific geniuses of their time, nearly all of us can be intelligently aware citizens in a scientific world.

It may bolster your self-respect, assuming that it should need bolstering after adding up your score, to know that some of the country's best scientists who have looked over the examination have good-humoredly admitted they would hesitate to attempt to pass it in competition with these teen-agers whose eager minds are absorbing and questioning everything new under, and including, the sun.

The current realization that American education is considerably less efficient than it could be in discovering and training top flight minds has aroused public appreciation of programs to improve the situation, many of which pre-date sputnik by some months and years. Such programs have not been designed to compete with the number of Russian "pressure-cooked" science students, but to develop one of America's richest and most neglected resources.

It is inconceivable that this country should even attempt assembly-line production of sheer numbers of scientists and technicians. The emphasis is much more likely to be on quality rather than quantity, and it will be encouraged among highly qualified young people who want to enter scientific careers because of their natural inclination and talent.

This emphasis on quality has been the guide line of the Science Talent Search since its beginning in 1942. In addition to the annual records kept of winners, an intensive study of early winners is now being conducted under a National Science Foundation grant. This compilation of detailed histories is expected to yield a large amount of new and accurate information on just what makes a research scientist—and what he does with his ability in maturity.

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

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