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General Science

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which will take charge of the organization of the Junior Academy until it can assume control of its own work. This committee consists of Dr. C. W. Lantz, Iowa State Teachers College, Chairman; Dr. J. C. Gilman, Iowa State College, Professor Frank Goodell, East High School, Des Moines; Dr. F. E. Brown, Iowa State College; and Dr. C. J. Lapp, Iowa State University. Aid will be given as follows: (1) Provide a plan of organization for clubs and issue charters to organized clubs. A constitution subject to amendment by the Junior Academy has been prepared and will be submitted to science clubs who wish to become a part of this state organization. (2) By means of mimeographed material suggest science projects, suitable club program materials, and lists of available speakers. It might be possible later for a Junior Academy to have a publication of its own for the exchange of ideas. Illinois has such a publication. (3) Arrange for a state meeting of the Iowa Junior Academy to be held next May in conjunction with the annual Senior Academy meeting. We plan to have a program of interest to high school boys and girls. (4) Provide prizes for science projects carried out by high school clubs. These projects will be exhibited at the state meeting and prizes will be awarded at that time. The Academy voted at their last meeting to award a trophy to be known as the Iowa Academy of Science Trophy to be given for the best science project exhibited. It is planned to have other awards given at the annual meeting. A list of awards and the rules for competition will be available at a later date.

What kind of clubs will be accepted in a Junior Academy? Any branch of high school science or mathematics may form a club and is eligible for membership when they adopt the constitution. It might be a physics club, a biology club, a bird club, a health club, or a mathematics club. The aim is to be quite liberal in the interpretation of the definition of a science club and to give each club much freedom in its own work, but to offer it the prestige and advantages that would come with the affiliation with other similar clubs in a state organization.

Much of the success of this movement will depend upon the high school science teachers. It is very true that the average high school teacher has a very full schedule, but here is an opportunity to put a new zest and new interest into high school science.

While the Iowa Academy of Science wishes to give aid to the teachers of science in their club work and provide a state organization, it in no way wishes to dictate to a club. Each club will have its own peculiar conditions and should be given much freedom.

It is planned to have a luncheon at the State Teachers Meeting in Des Moines in November for all of those interested in the Junior Academy movement. Plan to be there and we can talk it over. Further announcements concerning this luncheon will be made at a later date.

You will find enclosed with the Science Bulletin this month a blank for you to fill out and return. We would much appreciate receiving suggestions from those who have had successful clubs in the past. Tell us how you have done it. By all working together we can make the high school science club work in Iowa through the Junior Academy of Science a movement of much significance to high school science and one that will be recognized throughout the United States. We would apreciate hearing from every high school science teacher in Iowa. Send in your suggestions and criticisms. Fill out the blank and return to my address.

C. W. Lantz, Chairman of High School Relations Committee, Iowa Academy of Science, care of Iowa State Teachers College, Cedar Falls, Iowa.

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GENERAL SCIENCE

What is General Science? It is wholly an environmental study—not merely one's natural environment but more particularly his man-made environment. In this day and age three-fourths of a man's existence is spent in an environment of invention whether it be in the home or on the street. One of the great accom-

plishments of science is found in the fact that it has created a world of magic through the agencies of numerous inventions. When one examines any invention he finds that its basic principle comes from nature. To illustrate: At present there is a marvelous activity in home refrigeration. The two processes applied in this are condensation and evaporation. Certain gases are condensed into liquids and then allowed to evaporate rapidly, producing cold. Man first witnessed these processes in nature. Water is evaporated from the Gulf of Mexico, then it is driven into the cooler latitudes of Iowa where it condenses and falls as rain upon our fields, helping to produce our tall corn. Evaporation and condensation which we are now beginning to use artificially are two of the life producing processes of nature. I could in like manner take any other invention of man with which I am familiar and show you how it illustrates natural law.

Now, how does General Science plan its environmental study? Practically every text I have examined on General Science plans it primarily on the three basic sciences; physics, chemistry, and biology. There was a time in the history of the world prior to the Renaissance when physics (including astronomy, of course, since it is simply a phase of physics) was considered the basic science. In the latter part of the 18th century Lavoisier demonstrated experimentally the great basic concept of nature known as Conservation of Matter. This placed chemistry firmly in the field of intellectual endeavor as a true science; one fit to rank as the second basic science. The middle of the 18th century witnessed the birth of the third basic science, known as biology. This science rests squarely on the great theory of evolution first announced by Lamarck and Darwin and later amplified by DeVries, Mendel and others.

When I was a student at high school I was required to study two different sciences every year beginning with the sophomore year. In this way I went through Cooley's Natural Philosophy, Steele's Astronomy, Geology, Botany, and Chemistry. This medley continued for quite a number of years after I left the high school. However, progress in scientific pedagogy finally declared its foolishness. For quite a number of years now, such sciences as systematic botany, zoology, geology, astronomy and physical geography have been dropped from the curriculums of high schools, since it was evident they could not be studied with profit without first a thorough grounding in the three basic sciences, physics, chemistry and biology. Hence general science came into existence emphasizing the basic concepts of physics, chemistry and biology. This is naturally followed in the high school by a more technical presentation of these sciences for those who care to ge beyond the general phases.

Special emphasis is always given in General Science to physics and chemistry. This is only reasonable when one considers that EVERY basic concept of nature with the exception of one emanates from these two branches. The one exception is the doctrine of evolution and its ramifications. The doctrine of conservation of energy, the doctrine of the conservation of matter, the relation of heat to mechanical work, the gravitational constant, the velocity of light, the concept of absolute zero, the electron, the proton, the quantum and the great electro-magnetic conception of matter are some of the foundation stones of nature; animate and inanimate. Quite a number of basic concepts of secondary importance could be mentioned, all of which emanate from physics and chemistry. Furthermore, all of these concepts can be grasped by an elementary student when presented by one who is trained to speak with authority in these two branches. Even the biological sciences are helpless without physics and chemistry.

What is the proportion of these basic sciences in the standard texts on General Science? Dr. Getchell was kind enough to examine the General Science texts on our shelves to determine the percentage of these three basic lines presented in them. The nine texts consulted are as follows: Pulmacher and Vosburg, Caldwell and Curtis, Wood and Carpenter, Snyder, Tower and Lamb,

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knowledge of the topic which, during its study, should be rated as of major importance. The latter suggests a sugar-coated pill. The pupil is hardly conscious that he is acquiring the knowledge, habits and skills with which this great science is so ably fitted to endow him. Yet the skilful teacher, who appreciates and applies his opportunity, will find not only an immediate response to his teaching in the direct evidences of mastery but an indefinable, immeasurable, permanent benefit as measured by the indirect evidences.

Additional help is offered the teacher in the Appendix, some part of which will be of value in every Chemistry course. This section includes, topics for supplementary study and reports, general experiments, extra experiments, lists of supplies for the pupil's desk and the stock room, and a bibliography of high school texts and manuals, general references, encyclopedias, popular books, books on testing and on teaching. Such lists are not necessarily complete, but are suggestive.

The authors made no claim to infallibility, but they did their best in the time allotted; column headings have been exchanged on some pages, but on the whole the book is well arranged and neatly printed. The real test of the value of the State Chemistry Course of Study for High Schools must be delegated to the high school Chemistry teachers of Iowa. You are cordially invited and urged to study it consistently, to use it intelligently and to criticise it constructively.

R. W. Getchell.

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Parsons, Hodgdon, Washburne and Caldwell, and Eickenberg. The average per cent of physics and chemistry in these texts was 51.1%. Including astronomy, which is also physics, the percentage was 54.5%. The average per cent of natural sciences inculding entomology, zoology, botany and geology was 10%. The remaining part of the texts is made up of such miscellaneous subjects as hygiene, bacteriology, agriculture, home economics, and sometimes a few pages of meteorology.

In the light of the above analysis what would make a good preparation for the teaching of general science? In the first place, it is evident that the teacher should have a good foundation in general physics from a college view point. He should also be versed in the elements of general chemistry covering the division of metals and non-metals. Next to these two sciences and of equal importance with either comes naturally elementary biology. The biological outlook should carry proper laboratory experience with it.

Now to the odds and ends. As the above would probably cover only two-thirds to three-fourths of the necessary preparation for efficient general science teaching, the next essential for a general science teacher would be some knowledge of geology and mineralogy. A thorough knowledge of what is given in Chapter IX of Brownell's Physical Science published by McGraw-Hill Book Company, would be abundant. Besides this geology, there should be a clear understanding of the make-up of the solar system and a knowledge of the most important general facts about the stars in the heavens. The teacher could use a bit of star gazing profitably in his teaching providing he is familiar with some of the principal constellations, viz., Ursa Major, Ursa Minor, Orion, Cepheus, Cassiopeia, and especially with the signs of the zodiac.

With these two minor subjects of astronomy and geology we should include, of course, some knowledge of elementary systematic botany and zoology besides a little of meteorology and bacteriology. These minor subjects could be mastered, and afterwards extended, from reading what is given in several of the best tests on general science designed for ninth grade work. The main thing is to understand thoroughly the elements of physics, chemistry and biology, the three foundation lines of science.

L. Begeman.