

43. The kind of rays emitted and the HALF LIFE (the time in which half the radioactivity decays) is a constant characteristic of each radioactive isotope of every element, and is used to identify that isotope.

44. In general, the gamma rays are very penetrating, the alpha and beta rays less so. Even though the alpha and beta rays are not very penetrating, they have enormous SPEED.

45. The speed with which atom particles travel is the source of atomic energy. ENERGY is capacity to do work. It is work stored up for future use.

46. If you raise a weight to a height above the ground and suspend it there by some device, the WORK you put into raising it can be stored there indefinitely as POTENTIAL ENERGY. It will be there, ready, whenever you decide to release it.

47. The energy which a moving body has because it is in motion is called KINETIC ENERGY. The kinetic energy of any particle depends upon its mass and the square of its velocity. Energy is conserved by the moving particle until it strikes an object, then work is done.

48. All ENERGY is either potential or kinetic. Either one can be converted into the other. These two conversions are continually occurring.

49. Particles of atomic size have kinetic energy arising from several different kinds of MOTION. All atoms are constantly in motion.

50. If the atoms are so dispersed that the material constituting them is a GAS, that gas will exert pressure on all sides of the container that holds it, on account of the motion of the gas molecules.

51. Atoms which compose an element that will combine readily with another element, as hydrogen or carbon will combine with oxygen, have unsymmetrical arrangements of the outer electrons in their systems. These unsymmetrical arrangements tend to set up a sort of strain, which causes CHEMICAL COMBINATION to take place when elements with suitable combining powers are brought together.

52. These unsymmetrical arrangements give rise to FORCES which result in kinetic energy. This energy appears, for example, when carbon and oxygen burn to carbon dioxide, giving off heat, or hydrogen and oxygen explode to form water, again giving off heat.

53. Chemicals combining to form stable compounds give off energy in the process. These are known as EXOTHERMIC REACTIONS. Combinations which absorb energy, forming unstable compounds, are known as ENDOTHERMIC REACTIONS. Explosives, for example, which are highly unstable, are formed by endothermic reactions.

54. Chemical forces, electricity and heat are all forms of energy. Potential and kinetic energy may be distinguished in each case.

55. These energies all arise from motion of the atom as a whole, or motion resulting from attractions and repulsions between the outer PLANETARY ELECTRONS of the atom's structure.

56. Energy resulting from motion of particles deep within the structure of the atom was unknown until the discovery of RADIOACTIVITY.

57. Radioactive elements undergo SPONTANEOUS breaking up of their atoms, giving off alpha and beta particles and gamma rays. Loss of these particles causes the radio-active elements to change into other elements.

58. The energies shown in these TRANSFORMATIONS are thousands of times greater than the kinetic energies which the molecules of a gas have by reason of their motion when heated. They are thousands of times greater than the energy changes per atom in chemical reactions.

59. The property of matter that connects it with motion is INERTIA. Inertia is opposition to change of motion.

60. One conclusion that appeared early in the development of the theory of RELATIVITY is that the mass due to inertia of a moving body increases as its speed is increased.

61. This increase implies an equivalence between an increase in energy of motion of a body (kinetic energy) and an increase in its MASS.

62. It is for this reason that Einstein suggested that studies of radioactivity might show the EQUIVALENCE of mass and energy.

63. Einstein's statement is that the amount of energy, E, equivalent to a mass, m, is given by the equation $E=mc^2$ where c is the VELOCITY OF LIGHT.

64. From this equation, one kilogram (2.2 pounds) of matter, if converted ENTIRELY into energy, would give 25 billion kilowatt hours of energy. This is equal to the energy that would be generated by the total electric power industry in the United States running for approximately two months.

65. Compare this fantastic figure with the 8.5 kilowatt hours of heat energy which may be produced by BURNING an equal amount of coal.

66. Until the atomic power research program, no instance was known of matter being converted into energy without more energy being used to produce the transformation than was released by it.

67. Two axioms of physics state: (1) MATTER can be neither created nor destroyed; (2) ENERGY can be neither created nor destroyed. For all practical purposes they were true and separate principles until about 1940.

68. It is now known that they are, in fact, two phases of a single principle, for we have discovered that energy may sometimes be CONVERTED into matter and matter into energy.

69. Such conversion is observed in the phenomenon of nuclear FISSION, a process in which atomic nuclei split into fragments with the release of an enormous amount of energy.

70. The extreme size of the CONVERSION FACTOR explains why the equivalence of mass and energy is never observed in ordinary chemical combustion.

71. We now believe that the heat given off in such COMBUSTION has mass associated with it, but this mass is so small that it cannot be detected by the most sensitive balances available.

72. Transformation of matter into energy is an entirely different sort of phenomenon than the usual chemical transformations, where the matter is changed into a different form but its MASS persists.

73. From the standpoint of the Laws of the Conservation of Matter and of Energy alone, transformation of matter into energy results in the DESTRUCTION of matter and CREATION of energy.

74. The OPPOSITE transformation, which astronomers believe may be going on in some of the stars, amounts to the destruction of ENERGY and the creation of MATTER.



HIGH-VOLTAGE GAS TESTER—
Breakdown limits of new types of gases for possible use in transformers, replacing oil, are determined in this "howitzer" at Westinghouse Research Laboratories. Up to 600,000 volts may be used; when the electrical surge becomes too powerful for the gas, it leaps from one electrode to another. Gas-filled transformers could be lighter and smaller than present types.

ENTOMOLOGY

Plant Growth Compounds Aid Mosquito Egg-Hatching

► MOSQUITO eggs are helped to hatch by some of the same chemicals that stimulate growth in plants. This renders all the more probable the suspicion held by many entomologists, that their eggs are similarly helped in nature by plant substances dissolved in the water on which they are laid.

Influence of synthetic plant growth-



WYOMING

Ride, fish, geologize or just relax. How?

Paton Ranch will give you trout fishing in a mountain stream as it flows out of a canyon in the Big Horn Mountains, daily horseback rides along the picturesque trails and excellent food—most of which is grown on the ranch.

The region abounds in geological and historical interest—dinosaur bones, marine fossils and Indian implements are found nearby.

Write for folder—Paton Ranch, Shell, Wyoming

Do You Know?

Of the 96 *chemical elements* known to man, some 35 to 44 are used in most of today's automobiles.

Sodium phytate, a corn chemical, promises to be useful as a water softener, and in rustproofing and textile conditioning.

Infra-red light is used successfully to heat and dry pine tree cones to obtain the seed; it accomplishes in four hours what formerly required two days.

Ramie is a crop with a promising future in America; when its gum is removed, its fiber makes durable fabrics, and its dehydrated leaves make an excellent cattle feed.

ASTRONOMY

Two Faint Stars Found To Increase in Brightness

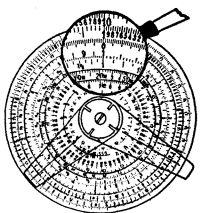
➤ TWO faint stars recently have been found to suddenly increase in brightness, according to reports received at Harvard College Observatory.

Dr. B. S. Whitney of the University of Oklahoma reported that photographic plates he made June 2 and 3 show a tenth magnitude star not visible several years ago. Its right ascension is 19 hours, 47.3 minutes; its declination is plus 36 degrees, 11 minutes. This discovery was confirmed by observations at Harvard's Oak Ridge Station.

The International Astronomical Union reports information from Moscow of the discovery of a ninth magnitude nova one degree south of Beta Serpentis. Thus "new star," far too faint to be seen without a telescope, is in the constellation of the serpent, now high in the southeast.

Science News Letter, June 19, 1948

THE BINARY SLIDE RULE



equals a 20 Inch Straight Slide Rule in precision. Has C, CI, A, K, LOG, LL1, LL2, LL3, LL4. Binary. Add and Subtract Scales. Gives Trig. Functions from 0 to 90 degrees 1 Minute. The Engine-divided Scales are on white coated aluminum. Permanently accurate. Dia. 8 1/4". Large figures and graduations eliminate eyestrain. Approved at leading Universities.

Price, with Case and Instructions, \$7.25. Circulars free. Your money back if you are not entirely satisfied.

Gilson Slide Rule Co., Box 993, Stuart, Fla.
Slide Rule Makers since 1915.

promoters on mosquito eggs was investigated by Albert Abel-Malek, in the laboratories of the Ohio State University. He used very dilute solutions of three of them: indole acetic, naphthalene acetic and indole butyric acids, as well as an infusion of bluegrass stems in water, and finally pure distilled water containing nothing else whatever.

The mosquito eggs hatched well on the three chemical solutions and the grass infusion, but the control eggs on absolutely pure water failed to turn out a single wiggler.

Mr. Abel-Malek presents a detailed report of his experiments in the *Annals of the Entomological Society of America* (March).

Science News Letter, June 19, 1948

PSYCHIATRY

Our Mental "Aching Back"

Author draws on his war experiences for suggestions, which he believes, will help us meet our aching back problems in civilian life.

➤ "OH, my aching back," GI Joe's favorite and most symbolic slang phrase during the war, applies to the whole world now and will for some time to come.

So declares Dr. William C. Menninger, general secretary of the Menninger Foundation and chief consultant in neuropsychiatry to the Surgeon General of the Army, 1943-1946.

A kind of prescription for warding off "the aching back" in these days of heavy world and personal burdens and stresses is to be found in Dr. Menninger's new book *Psychiatry in a Troubled World* (Macmillan). Dr. Menninger refers to the mental and emotional troubles, rather than a physical backache.

Drawing on his war experiences with the millions of "Joe's and Mary's from Brooklyn and Kokomo" who made up our huge war machine, he gives nine factors which helped the Joe's and Mary's stay normal in spite of war's stress and strain. These same nine, he believes, will help each of us meet our aching back problems in civilian life. They are:

1. Recognition of the existence of a struggle between the personality and the environment.
2. A job with a purpose.
3. Teamwork. Working with a group helps the worker as well as the group, is good for mental health.
4. Leadership. This works both ways, too. Most of us have to work under someone, but most of us also are leaders at times, either as parents, teachers, foremen or presidents of clubs.
5. Intellectual growth, getting new ideas, learning new things.
6. Promotion, for the individual and

for the family, the neighborhood, the city, the state and the nation.

7. Recreation.

8. Religion. Like most psychiatrists Dr. Menninger believes there is no antagonism between religion and psychiatry.

9. New awareness of emotional conflicts, of the occurrence of "operational fatigue" in civilian as well as military life.

Science News Letter, June 19, 1948

PHOTOGRAPHY

Gage Radioactive Elements In Rocks with Photography

➤ ESTIMATION of the amount of atomic energy elements, uranium and thorium, in rocks may be done in the future by photography.

Dr. J. H. J. Poole, and J. W. Bremner of Trinity College, Dublin, have placed special nuclear research photographic plates in contact with flat surfaces of rocks cut with a diamond saw and left them there for one to three weeks. Stars with two to five rays appear in the photographs caused by the alpha particles or the hearts of helium atoms that are given off from the radioactive elements.

Distribution of radioactive elements in rocks is shown to be very sporadic, especially in coarse grained rocks like granites, they declared in a report to *Nature* (June 5).

The photographic method was originally suggested two years ago by Mme. Irene Curie-Joliot, Nobelist herself and daughter of the Curies who discovered radium.

Science News Letter, June 19, 1948