physical sciences notes

ASTRONOMY

September solar eclipse unusual

This year's only total eclipse of the sun will occur Sept. 22. The path will cross mostly the great Russian land mass, ending in western China.

This solar eclipse has an uncommon feature—totality begins at sunset for its northernmost contact and ends at sunset at its southernmost point. The usual pattern is for the lunar shadow to strike the earth at sunrise and leave it far to the east at sunset.

Several factors help contribute to the unusual eclipse. One is that the eclipse occurs within half a day of autumnal equinox, so the angle as seen from the sun between the earth's axis of rotation and the ecliptic has its full value of 23.5 degrees.

Another important factor is that the moon is still about 10 degrees from the descending node of its orbit, so it is also well north of the ecliptic plane. The lunar shadow, therefore, first falls on high terrestrial latitudes, tracing a roughly counterclockwise semicircle along the surface.

Other influencing factors are the speed of the moon in its orbit, faster than average because it is close to perigee, and the curvature of this planet toward the moon, Dr. Edward M. Brooks of State University College in Plattsburgh, N.Y., reports in the June SKY AND TELESCOPE.

CHEMISTRY

Inorganic cyclic polymers developed

Polymers whose connecting links consist of alternating silicon and nitrogen atoms instead of the usual carbon atoms, have been developed in the laboratory. They are reported to be unusually heat stable, resisting decomposition at temperatures as high as 480 degrees C.

Other physical properties of the polymers vary with the aromatic constituents locked into the cyclic silicon-nitrogen backbone. Some are extremely tough, while others are flexible and rubbery, Dr. Walter Fink of Monsanto Research SA reports in HELVITICA CHIMICA ACTA for May 31.

Although molecular weights have not been measured precisely, Dr. Fink estimates one type of polymer to be composed of 15 to 20 cyclodisilazane units, which would give it a weight of about 4,000 to 6,000. The new polymers differ from previously known silicon-based polymers, the silicones, in having nitrogen in their rings instead of oxygen.

GEOASTRONOMY

Biological effects of supernovas

The possibility that cosmic rays formed during supernova explosions could have killed animal life on earth is discussed from differing viewpoints in the June 7 SCIENCE.

Drs. W. H. Tucker of Rice University in Houston and K. D. Terry of the University of Kansas in Lawrence raised the question of the possible biological effects of supernovas. They note the paleontological record shows periodic mass extinction of large groups of animals, although not plants, that could result either from direct killing or from sterilization.

Dr. Howard Laster of the University of Maryland suggests that some form of photon radiation, whether ultraviolet, X-ray or gamma ray, would be more likely to have such an effect since photons travel in a straight line. Cosmic rays are charged particles and their paths are twisted by magnetic fields.

Drs. Tucker and Terry calculate radiation doses of the order of 100 rads would be expected from high energy gamma rays produced by explosions of supernovas 100 light years distant, a factor of three less than they had suggested for cosmic ray particles.

CHEMISTRY

Nitrogen fixed by ruthenium

Ruthenium has been found able to grab relatively inert nitrogen gas from the atmosphere at normal temperatures and pressures, and change it into an active form that can be utilized by plants.

Chemists at the University of Toronto have shown that ruthenium, a grayish white metal somewhat harder and more brittle than platinum, possesses a capability shared only by a few bacteria—the natural fixation of nitrogen. Vast quantities of chemically active nitrogen are used in the manufacture of fertilizers, ammonia, nitric acid, rocket fuels and high protein food.

A process for fixing nitrogen cheaply has been sought by scientists for more than 100 years. Most man-made processes thus far investigated require temperatures of around 500 degrees C. and pressures of about 1,000 atmospheres.

Ruthenium itself is probably too expensive—$60 an ounce—to be used in commercial production. However, the discovery is expected to lead to a better understanding of how nitrogen is fixed naturally and could provide a stepping stone to the development of a workable room-temperature process.

Dr. Albert D. Allen, dean of Arts and Science at the University of Toronto, and Dr. Frank Bottomley report their result to the Chemical Institute of Canada. Interest first focused on ruthenium when a compound of that transition element and nitrogen turned up as an unexpected and unwanted experimental product.

SOLAR SYSTEM ASTRONOMY

Moving center of mass

The sun contains 98 percent of the mass in the solar system, with the superior planets beyond Mars accounting for most of the rest.

On the average, the center of mass of the sun-Jupiter system, when the two most massive objects are considered alone, lies 462,000 miles from the sun's center, or some 30,000 miles above the solar surface. Other large planets also influence the center of mass of the solar system, however.

In 1951, for example, the system's center of mass was not far from the sun's center because Jupiter was on the opposite side from Saturn, Uranus and Neptune.

In the late 1950's, when all four of these planets were on the same side of the sun, the system's center of mass was more than 330,000 miles from the solar surface, Dr. C. H. Cleminshaw of Griffith Observatory in Los Angeles has calculated.