questions and problems, and is likely to continue to be a popular manual on the outlines of inorganic chemistry and chemical philosophy.

MESSRS. MACMILLAN AND CO., LTD., have issued a new and revised edition of stage vi. of Mr. Vincent T. Murché's "Object Lessons in Elementary Science," the price of which is 2*s*.

A FIFTH edition of Mr. W. W. Fisher's "Class Book of Elementary Chemistry" has been issued by the Clarendon Press, Oxford. The text has been entirely revised, and numerous additions have been made. Several chapters on organic chemistry, intended to serve as an introduction to this division of the subject, have been included in the new edition, which is now in line with the present state of knowledge of the subjects dealt with in the volume.

OUR ASTRONOMICAL COLUMN.

JUPITER'S SIXTH AND SEVENTH SATELLITES.—A telegram from Prof. Pickering to the Kiel Centralstelle announces that Dr. Albrecht has observed the recently discovered sixth satellite of Jupiter with the Crossley reflector of the Lick Observatory. The times of observation and the determined positions were as follows:—

G.M.T.	Position angle	Distance
	°	′
1905 July 25·95 ...	55·0 ...	25·1
,, 26·97 ...	52·7 ...	24·3
,, 27·93 ...	50·7 ...	23·6

(Circular No. 77, Kiel Centralstelle).

In Bulletin No. 82 of the Lick Observatory Dr. Frank E. Ross publishes the following set of elements for the orbit of Jupiter's seventh satellite, which he has computed from the observations made by Prof. Perrine on January 3, February 8, and March 6:—

Ecliptic Elements.

Mean Jovicentric Longitude at Epoch ...	333°·55	1905 Jan. 0·0 G.M.T.
Longitude of Perijove	336·65	
,, Node	237·23	
Inclination to Ecliptic	31·0	
,, Jupiter's Orbit	32·0	
Longitude of Node on Jupiter's Orbit ...	238·6	

Elements referred to Earth's Equator.

Mean Jovicentric Right Ascension... ...	328·18	1905 Jan. 0·0 G.M.T.
Right Ascension of Perijove	331·28	
,, ,, Node	281·13	
Inclination to Equator	26·2	

Mean Daily Motion = 1°·358

log a = 8·9004

a = 52′·54 (for log Δ = 0·71624)

e = 0·0246

P = 265·0 days

Distance at maximum elongation = 70′.

Calculating from these elements the positions at the times of Prof. Perrine's observations, it was found that the residuals were satisfactorily small, but for five intermediate dates, on which observations were secured, they proved to be larger than were expected. Dr. Ross accepts this result as evidence of the large periodic perturbations, chiefly solar, to which the satellite is subjected. The above elements indicate that this satellite revolves about Jupiter in a *direct* orbit, for although a retrograde orbit was computed and found to fit the three primary observations, it did not agree with the positions obtained from the intermediate observations.

An ephemeris, covering the period July 1 to November 13, from which the following positions are taken, accompanies Dr. Ross's paper:—

	p.	*s.*		*p.*	*s.*
	°	′		°	′
Aug. 10 ...	294	26	Sept. 9 ...	292	53
,, 20 ...	293	36	,, 19 ...	291	58
,, 30 ...	293	45	,, 29 ...	290	59

On October 4 the distance will still be 59′, but after that date it will slowly decrease, until on November 13 it will be only 18′.

According to a note communicated by Prof. Perrine to the Astronomical Society of the Pacific, and reproduced in No. 4035 of the *Astronomische Nachrichten*, Dr. Ross has also computed the orbit of Jupiter's sixth satellite. This satellite, like the seventh, moves in a direct orbit, its period being 242 days. The eccentricity of the orbit is large, amounting to 0·16, and the inclination to the plane of Jupiter's equator is about 30°. The mean distance of the satellite from Jupiter is about seven million miles. Thus the periods, and therefore the distances from Jupiter, of the sixth and seventh satellites are nearly alike, their orbits mutually interlocking. Otherwise the two orbits are dissimilar.

THE FORMATION OF THE NEW NORTH POLAR CAP ON MARS.—According to Mr. Lowell's observations, as recorded in No. 22 of the *Lowell Observatory Bulletins*, the first frost of this year in the Arctic regions of Mars occurred on May 19. The region wherein the phenomena were observed had been under daily scrutiny since coming into view on May 11, but no new feature had been discovered. However, on May 19 an enormous, unmistakably white patch was seen which extended from the western edge of the old cap to a point on the terminator about one and a half times the old cap's diameter away, and reached down to latitude +63°. The deposit was so thin on its northern edge that the band girdling the old cap could be plainly seen showing through it, but on May 20 a bright nucleus formed on the southern edge of the frost-bound area.

The date of the first observation corresponds to August 20 in our calendar, and is 126 days after the summer solstice in the northern hemisphere of Mars. In 1903 the first frost effects were observed on Mars about 128 days after the summer solstice; thus the recent observation strongly confirms those made in 1903.

LIQUID AIR—PRODUCTION AND APPLICATIONS.[1]

IN the former of these papers the author details experiments showing the trustworthiness of a German silver platinum couple to measure temperatures in the neighbourhood of those of liquid air and liquid and solid hydrogen. The electric resistance of metals is an unsafe guide at very low temperatures, and the manipulation of gas thermometers involves much time and care. A thermoelectric junction would be much more convenient if trustworthy. That it is trustworthy the experiments go to show, but only within limits. If the constants of the formula for interpreting the observations be determined at temperatures between 90½° and 123½° abs., the formula will then give the temperature of solid hydrogen at low pressure as 15°·27 abs., whereas if the constants be deduced from experiments at a lower temperature, 20½° to 77½°, the interpretation formula then makes the temperature of solid hydrogen at low pressure 1¾° lower, *i.e.* 13°·5 abs., which the author considers more correct. Bearing in mind that at this very low temperature a difference of 1¾° is equivalent to a difference of 37° at the ordinary temperature, we see that the method has no confirmatory value, and can itself be trusted only over the range for which it has been verified by the careful use of gas thermometers. If, therefore, helium be procured in sufficient quantity for liquefaction or solidification, its lower temperatures, possibly within 5° of the absolute zero, will have to be ascertained by the low-pressure helium thermometer. For ranges of temperature over which its indications can be verified, the thermoelectric junction thermometer will have a useful sphere of work in saving the inconvenience of employing gas thermometers. Among important cautions given by the author is a warning that junctions made with soft solder are affected by the low temperature. The junctions should be made with hard silver solder, and the indications at the temperature

[1] "On the Thermo-electric Junction as a Means of Determining the Lowest Temperatures, and on Liquid Hydrogen and Air Calorimeters." Papers by Sir James Dewar, read before the Royal Society, June 8, 1905.