being submersed completely for fifteen hours in a beaker of distilled water free from air, they regain their normal activity within a quarter of an hour of their removal from water. I have not yet tried submersion for longer periods, but the subject is of great interest, and I should be obliged if any of your readers are able to throw any light upon it.

HENRY COHEN.

"Avenue House," Petworth Street, Cheetham, Manchester, September 2.

THE AUTUMN MOON.

LUNAR theory has become recently an engrossing study for all, and is not to be classed such a useless abstraction as before. The peculiar behaviour of the autumn full moon in our high latitudes has always attracted the attention of the hunter and farmer, and given it the name of harvest or hunter's moon, according as it comes next before or after the equinox.

This behaviour, which has attracted attention and given the name, will be on view at this full moon; it will be noticed how the time of moonrise will be very nearly the same during the inside of a week, the full moon coming up at sunset, or a little before or after.

The full moon on this September 30 is, then, strictly speaking, the hunter's moon, but may also be called the harvest moon in this backward season. The previous full moon of September 1, coming a month before the equinox, did not show up so clearly to a noticeable extent the peculiarity of a successive rising at sunset, with little or no delay.

The astronomical explanation is simple. At the autumnal equinox the full moon is passing through the ascending node of the ecliptic at the vernal equinox, and its motion from south to north of the ecliptic is quickest.

The usual retardation of rising due to the moon's motion along the ecliptic is diminished by the rapidly northing motion, and the effect is to reduce the retardation from an average forty-eight minutes daily in a month of thirty days to something considerably less, especially in high latitudes, where the retardation may sometimes be wiped out altogether, and the moon will rise earlier for a night or two. The same effect of diminished retardation takes place every month, while the moon is moving through the vernal equinox; but the effect passes unnoticed, as the moon is not full.

We begin by taking the moon to move in the ecliptic, but her orbit is really inclined at about five degrees, and the nodes of the orbit revolve in eighteen years. The effect is not the same, then, every year, but greater or less; and the modification can be investigated on astronomical theory from the numerical data of the Nautical Almanac. In some conjunctions it will be possible to see the full moon travel round the horizon, in a latitude five degrees short of the Arctic Circle, as in the northern parts of Sweden.

The effect is reversed and the retardation of rising is greatest when the moon passes through the autumnal equinox and is receding most rapidly from the pole star, as in the last old and new moon a fortnight ago.

The full moon at the vernal equinox will rise, or set, from an hour to an hour and a half, or two hours, later each night, and advantage can be taken if moonlight is to be avoided.

The words in "Macbeth," "The moon is down . . . And she goes down at twelve. I take 't, 'tis later, sir," would imply a moon about a week old, and moving through the autumnal equinox, making midsummer the time of the play. Shakespeare's education has been called in question, but he can always be relied upon for accurate observation, and is not content to take his natural philosophy out of a book, second-hand and unverified.

The moon is full in passing through the autumnal equinox when the sun is opposite in the vernal equinox—that is, in spring. This full moon will be observed to be very late in getting up and in setting again; but it has not attracted attention, as unconnected with any influence on human life.

It may be called Endymion's moon, from the legend of Mount Latmos, where we may suppose Endymion, an astronomer, had built his observatory within reach of Miletus. In the legend he drew the moon goddess down by the arts of a Thessalian witch, and in the springtime would not let the goddess go in a hurry. The scene has been utilised by Hardy in "Two on a Tower."

Mount Hamilton, with the Lick Observatory on it, resembles Latmos in being within reach of San Francisco. The journey there is a favourite pilgrimage and, in contrast to our Greenwich, visitors are encouraged to cheer up the solitude of the staff, and provide merriment after they are gone by their innocent questions. One Lund divinity visitor was reported to take a great interest in the life of young Endymion, and curious of his habits, she asked, "What do you do all night?" "We take the observations." "What do you do all day, then?" "We reduce the observations." "But why cannot you take your observations the right size once for all?"

The erratic behaviour of the moon in the sky has been a pitfall for artist and poet; the mistakes have provided much amusement to the astronomer. Turner, the artist, has painted the sun setting in the east in his picture of the old *Téméraire*. Hogarth's picture of "The Lady's Last Stake," now gone to America, in which Mrs. Thrale claimed to have sat for the lady's model, is intended to draw a moral on sitting up gambling all night, with the moon looking in reproachfully at the window. But the astronomer recognises a winter new moon, and the hour is about five o'clock tea time, so we may imagine the other members will be knocking at the door and asking, "When are you two coming in to tea?"

We still speak of new moon and old, and so perpetuate the ancient theory of Pythagoras that the moon is not a celestial body coming round every month, but a sort of magic lantern shown on the sky. This doctrine of Pythagoras is still

the orthodox theory in Turkey to-day, and to prove it, the national emblem of the Crescent shows a star shining through the moon; and Coleridge, in the first draft of "Christabel," is reported to have seated a star in the horns of the crescent.

The sun and moon go round like the hands of a clock, hour and minute, on the old Chaldæan estimate of a year of twelve lunations of thirty days. Full moon would occur when the two hands are in lines directly opposite.

A sundial, marked to serve as a moondial, like the old dial at Queens' College, Cambridge, will give forty-eight minutes added to moonlight time for every day of the moon's age, to give the corresponding sun time on the average.

A moon clock of greater accuracy and variation is required to mark the time when the moon is down longer than usual, drawn down in the legend by Thessalian arts, when the witch loves to ride through the air in the dark.

In "All for Love; or, The World Well Lost," Dryden writes:

> Her eyes have power beyond Thessalian charm
> To draw the moon from heaven,

and this was considered just the time for us to be most on our guard, during the coming winter; although this expectation has not been realised of late.

In ancient astronomical lore as well as in poetry, the sun and moon were pictured as living bodies, and an eclipse could be described as drawing them down to earth, the moon and sun.

Prior information of an eclipse was of great service to counteract superstitious fear, and to claim the magic power as on your own side; as in the case of the solar eclipse predicted by Thales, related by Herodotus, occurring in the middle of an important battle.

A lunar eclipse is so common as to attract little attention to-day; the frequent occurrence compared with a solar eclipse attracted the attention of Aristotle. But the lunar theory involved could be utilised by the Thessalian magician, and would have proved valuable to the Athenian general Nicias in his disastrous retreat from Syracuse.

G. GREENHILL.

THE RESOURCES AND PRODUCTION OF IRON AND OTHER METALLIFEROUS ORES.

IN order to meet what has apparently been a want both to those engaged in the iron and steel industry and to those who are interested in obtaining knowledge of the mineral resources on which the industry mainly depends, the Advisory Council for Scientific and Industrial Research has thought it desirable that a report[1] should be compiled summarising the latest information available regarding the iron-ore resources of the United Kingdom, as well as those of other countries. Although a vast amount of information has been published from time to time, it exists mostly in the form of reports and monographs scattered throughout the Proceedings of technical and scientific societies and in the very valuable publications of the Geological Surveys and Mines Departments of this country and of the principal Dominions of the British Empire; also in those of other countries, particularly the United States. Consequently much time and labour have to be spent in searching for the literature on the subject.

The aim of the report, therefore, has been to collect and present in a summarised form the main facts concerning the resources of iron ores and of other metalliferous ores accessory to the metallurgy of iron and steel, and to indicate their composition and character, giving as many analyses as possible of the minerals in every locality, with indications as to their geographical position and accessibility. The report is the work of Mr. G. C. Lloyd, the secretary of the Iron and Steel Institute, and it has been revised and added to by Prof. Henry Louis, of the Armstrong College, Newcastle-upon-Tyne.

The report is divided into three main parts, of which Part i. deals with the iron ores of Great Britain and Ireland and of the British Dominions. It is known that large resources of iron ores exist in the United Kingdom, but in certain districts, owing to their mode of occurrence, as well as the low percentage of iron which the ores contain, it has been difficult to work some of them profitably. Foreign ores, especially those of Scandinavia, which are of high-grade quality, have been imported so cheaply into this country that the native lean ores could no longer compete with them. Native ores have therefore to a great extent been disregarded, and expenditure upon their development has not been worth while on account of the ease with which cheap supplies of much superior ore could be obtained from abroad. The ores of the United Kingdom are described in approximately the following order:—

(*a*) Red and brown hæmatites and magnetites (Cumberland, Lancashire, Cornwall, Devonshire, and the Forest of Dean), and the aluminous ores of Co. Antrim, Ireland. These are estimated at about 500 million tons.

(*b*) Carbonate ores or ironstones (Cleveland, Northamptonshire, Rutlandshire, and Leicestershire), and the calcareous ores of the Lower and Middle Lias (Lincolnshire, Oxfordshire, Wiltshire, and Somerset). Reserves of these are estimated at about 5000 million tons, but it is thought that probably this figure is too low. Both in Cumberland and Northamptonshire new developments in iron-mining are now taking place on a considerable scale. Some attention has also been lately directed to the Cornish iron ores, but it is extremely doubtful whether these can be worked again upon any important scale.

(*c*) Stratified iron ores of the Coal Measures (Scotland, Northumberland, Staffordshire, Derbyshire, Shropshire, and South Wales). Reserves of these are estimated at about 34,000 million tons. In normal times by far the largest proportion of the above quantities cannot be worked with profit.

[1] Department of Scientific and Industrial Research. Advisory Council. (London: H.M. Stationery Office.) Price 2s. net.