tive deck, through the riding bitts on the upper deck, after the tops of these became submerged.

We thus obtain a total of 1,110 tons of water which entered the ship through the breach made by the collision and passed into other compartments, besides those directly laid open to the sea, through open doors, hatches, &c.; a further amount of 100 tons that entered after the tops of the riding bitts became submerged; and 665 tons about which there may be doubt as to the precise positions of the compartments it entered.

4. *The effect of the water thus admitted upon the line of flotation and the stability.*—The 1,110 tons of water above mentioned would, according to the Admiralty calculations, considering its position at the fore-end of the vessel, depress the bow to the extent of 21 feet, and raise the stern 8 feet. This change of waterline is considered to have necessarily flooded the other compartments, respecting which the direct evidence is doubtful; and certainly to have filled the boatswain's and carpenter's stores through the riding bitts. The turret ports, and also the door on starboard side, and the ports, in the upper deck battery, would thus be brought under water, and the position of the ship be rendered hopeless.

Mr. White states, with regard to the stability, that as the *Victoria* floated before the collision, she had a metacentric height of 5 feet—*i.e.* the centre of gravity was 5 feet below the point at which its righting effect would be *nil*—and that after the collision, when the bow had sunk deeply and she had heeled considerably—by how much is not said—the metacentric height was reduced to about eight-tenths of a foot. When water had entered the battery and turret through the open door and ports, as observed when the fatal lurch began, the metacentric height had become altered by the changed condition to *minus* 1·8 feet; and the final capsize was inevitable.

A consideration of the fifth subject treated in these minutes, which is the lessons taught by circumstances connected with the loss—the most important of all for the future—will require an article to itself, and must therefore be postponed till another week. The points mentioned in this connection are: the effect of longitudinal bulkheads upon safety in such circumstances as are those under discussion; whether the closing of the battery doors and ports would alone have been sufficient to save the ship; whether the closing of all water-tight doors and scuttles would have done so; whether the water-tight doors fitted to the ship were the best for the purpose; the value of an armour-belt at the ends for the purpose of resisting damage; and whether the blame rests wholly upon the officers of the *Victoria* for not knowing how rapidly the ship would be likely to sink when damaged as she was, and for not taking steps sooner to close the water-tight doors and scuttles and prevent the final catastrophe.

FRANCIS ELGAR.

JUPITER AND HIS RED SPOT.

JUPITER is now, with his northern declination of 18° and an equatorial diameter of 48″, a very fine object visible above our horizon during more than 15 hours at a time. Thus, on December 1 he rises at 3h. 7m. and sets at 18h. 23m., shining nearly throughout the long nights now prevailing from a position about 6° south-south-west of the Pleiades.

As an object for telescopic study Jupiter is undoubtedly the most interesting planet of our system. The activity apparent everywhere on his surface, the number and variety of the forms displayed, and the comparative ease with which they may be observed, attest that this object is practically without a rival, and that the investigation of his phenomena is certain to be productive.

The present time is eminently a suitable one for studying his surface markings, and redetermining their proper motions. As the planet's rotation period is less than 10 hours, the times of transit of the same spots may sometimes be obtained twice on one night, for if a marking crosses, say, 3 hours after the planet's rising, the same object will again reach the central meridian about 2½ hours before the planet sets.

It is well known that the visible surface of Jupiter consists of a number of light and dark zones interspersed with irregular forms which exhibit great differences in their rates of velocity. Certain white spots, bordering the equator, move very swiftly, and complete a rotation in considerably less time than the red spot. Some dark spots, which have appeared at various times on a double belt about 25° N. latitude, have moved more rapidly still, and shown a rotation in seven minutes less time than the red spot. But it is a peculiar feature of the different markings that they do not maintain the same rate of motion during their existence; in fact, a lengthening of period seems to generally affect them. Thus the red spot in 1880 gave a rotation of 9h. 55m. 34s., while in recent years it has been about 9h. 55m. 41s. The equatorial white spots, which thirteen years ago had a period of 9h. 50m. 6s., have been gradually moderating their speed until in the last few years their period seems to have been 9h. 50m. 30s. It is certain that the various markings are carried along in atmospheric currents, and are subject to remarkable differences, of which we do not comprehend the cause, though we may readily trace the effects.

The red spot situated in Jupiter's S. hemisphere, and on the boundary of the tropical and temperate zones of the planet, is still perceptible, and it is highly probable that the spot existed long before it first came conspicuously into notice in July, 1878. During the last fifteen years there has been little change either in its oval shape or in its dimensions, though its colour and visibility have suffered some trying viscissitudes. It has been successively presented as a brick-red spot, as a faint pink ellipse, as a grey shading, and it is now so feeble that only the outline of its following side can be distinguished, the preceding part of the spot having apparently lost its definite outline. In fact, there seems a prospect of losing the object temporarily if further decadence goes on, but in view of past experience and the probability of recurrence in the Jovian markings, we may certainly expect the spot to reappear, and to present a more conspicuous aspect than it does at the present time.

The following are some eye-estimates of the transits of the spot during the present apparition; they were made by Mr. A. Stanley Williams, of Brighton, and by myself at Bristol:—

Date, 1893.	Red spot at transit. h. m.	Marth's zero meridian. h. m.	Red spot precedes, m.	Observer.
Aug. 9	14 5	14 13·6	8·6	W. F. D.
14	13 15·5	13 22·1	6·6	A. S. W.
16	14 52·2	15 0·6	8·4	,,
16	14 55		5·6	W. F. D.
Sept. 4	15 31	15 41·8	10·8	A. S. W.
14	13 52·2	13 57·5	5·3	,,
Oct. 8	13 35·8	13 43·0	7·8	,,
18	11 50·4	11 58·0	7·6	,,
30	11 45	11 50·0	5·0	,,
Nov. 6	12 29·2	12 34·9	5·7	,,
23	11 25	11 33·9	8·9	W. F. D.

The spot therefore transits a few minutes before the zero meridian based on the daily rate, 870°27′ (=9h. 55m. 40·65s. for one rotation), System II. in Mr Marth's ephemerides (*Monthly Notices*, May, 1893).

Mr. Williams writes me that he has recently been able to make out the whole outline of the red spot except the preceding end, and on one very favourable night,

November 6, he glimpsed the spot in its entirety, and describes it as of a pinkish colour. The following and south following part of the spot had quite a dark and definite outline.

On October 31 the red spot was seen with the 16-inch refractor at the Goodsell Observatory, Northfield, U.S.A. It was not a difficult object, though the colour is stated as being very faint. "The S. side of the spot and a belt of similar tint appeared to merge into one another without the slightest change in intensity of colour."

On November 23 I observed the spot with an 8½-inch reflector belonging to my friend, Mr. J. Harvey Jones, of Bristol; but the night was not very good. The red spot was faintly seen, and must have been central at about 11h. 25m. Other details were also noticed as follows:—

A faint, narrow, dark belt, like an irregular pencil-line, on the equator. A similar belt running from about the *p.* end of the red spot to W. limb of the planet. The shouldering of the S. equatorial belt N. of the ends of the red spot was distinctly seen, though that part N. of the *p.* end was very faint. The *f.* shoulder shows a much more gentle slope than formerly. Numerous reddish spots were seen on the N. side of the N. equatorial belt. These were large and conspicuous, as were a series of bright spots *p.* and S. of the red spot. A remarkably brilliant spot on the N. side of N. equatorial belt was central at 10h. exactly.

The general appearance of the planet betokened a more disturbed condition than usual, the belts being full of irregularities.

The great size, durableness, and special character of the red spot have naturally attracted much discussion, and a number of theories have been broached to explain the nature of the spot, and to account for its long endurance. Some writers have regarded it as part of the solid material of Jupiter, but this theory is practically negatived by the fact that it has shown an irregularity of motion. Unless we admit that the rotation period of Jupiter is extremely variable, and has experienced considerable retardation in recent years, we cannot allow that the red spot forms a portion of the sphere. Others believe the spot to represent a condensation of material floating or suspended above the surface of the planet, and that variations of motion and tint are impressed upon it by the action of the Jovian atmosphere, which is constantly in a state of turmoil. Another idea has been mooted to the effect that the spot may possibly be an opening in the atmosphere, through which the surface of Jupiter has been exposed, and that the recent feebleness of the object is occasioned by the filling in of the cavity with highly reflective vapours.

The Rev. E. Ledger remarks that at one time he felt inclined to believe that the permanency of the spot "seemed to indicate that it might be something which, while coagulating or solidifying, in some way caused a gap or break in the cloudy regions above it, or by its cooling condensed the vapours incumbent upon it, and thus increased its own visibility; in fact, that we might be watching in it the gradual formation of a huge continent upon Jupiter."

The theory has also been advanced that the spot was originally formed by ejecta from a volcanic region immediately underlying it, but it must be admitted that no hypothesis appears to be entirely satisfactory in its application, and certainly we cannot regard any one of them as capable of being definitely proved. In a word, it must be avowed that though we have become familiar with the red spot, its motion, shape, and variable tints, during observation extending over more than fifteen years, we are yet far from understanding the mystery it involves. Its production was doubtless the outcome of the energy and activity prevailing above, and possibly on, the planet's surface, but in what particular way the spot was generated it is impossible to say. Nor is the specific date of its first apparition known; it may be a modern resuscitation of the spot which delighted Hooke and Cassini about two centuries ago, or it may only have been initiated into existence just before those memorable nights in July, 1878, when it exhibited an intensely red colour, and struck observers, instantly, as being a most anomalous feature.

But though the spot forms an unsolved mystery, it will continue to be watched with interest by telescopic observers, who will much regret if its present faintness is but the prelude to final dissolution. It can be justly said that no planetary marking visible in modern times has encouraged as much observation, and incited the same amount of interest as the familiar "red spot on Jupiter." Possibly the further study of this remarkable formation may yet enhance our knowledge of the physical condition of the "giant planet," and throw some light upon the singular variations so rife upon his expansive surface.

W. F. DENNING.

THE PREPARATION AND PROPERTIES OF FREE HYDROXYLAMINE.

A CONSIDERABLY improved method of isolating hydroxylamine is described by Prof. Brühl, of Heidelberg, in the current *Berichte*, by which a tolerably large quantity of the pure substance may be prepared without danger in a short space of time, and which may therefore be of general interest on account of its suitability for lecture and demonstration purposes. It may be remembered that M. Lobry de Bruyn, who first isolated solid hydroxylamine two years ago (*vide* NATURE, vol. xlv. p. 20), prepared it from a mixed solution of the hydrochloride and of sodium methylate in methyl alcohol. This solution, after removal of the precipitated common salt, was first concentrated over a water bath, under the diminished pressure of 100 m.m., and afterwards subjected to fractional distillation over a flame at the still lower pressure of 40 m.m. A continuous fractionating vacuum-apparatus was considered unsuitable, and the change of receivers could only be conveniently effected by temporarily arresting the distillation. This mode of operating frequently led to violent explosive decomposition of the heated hydroxylamine, and, moreover, the yield rarely exceeded 17 per cent. of the theoretical. Prof. Brühl, desiring to obtain a considerable quantity of the pure base for spectrometric purposes, has been led to devise the following much more convenient method:—

The methyl alcohol solution is first separated from the precipitated salt, and then immediately transferred to a slightly modified form of the well-known apparatus of Prof. Brühl for fractional distillation *in vacuo*. This apparatus consists essentially of a distilling flask, provided with thermometer and entrance tube furnished with tap, a condenser, and a receiving arrangement which provides for the repeated and rapid change of receiver without impairing the vacuum and without arresting the distillation. This receiving arrangement consists of a short but wide cylinder of stout glass, into which the end of the condensing tube is introduced through a tubulus fitted with bored caoutchouc stopper; inside the cylinder is a circular stand carrying six receiving tubes, which are capable of rotation by means of a rod passing, gas-tight, through a tubulus and its caoutchouc stopper in the top of the cylinder, and terminating in a handle outside. By suitable manipulation of the handle, each of the six receivers may be brought beneath the end of the condensing tube in turn while the distillation is proceeding. The distillation of the methyl alcohol solution contained in the distilling flask is effected by reducing the pressure to the lowest possible amount, and supplying the necessary heat by immersing the flask in a bath of hot water. On