Fig. 7.   (a) Probability density distribution in the 3-dimensional representation of the squares of hydrogen atomic orbitals observing through y axis. Glass size: $4 \times 4 \times 4$ cm. (b) Schematic representation of the planar and conical nodes symmetrical about z axis.

Figure 7(a) shows 36 orbitals for values of principal quantum number n from 1 to 6, and values of azimuthal quantum number $l = n - 1$. These orbitals have no spherical node. Looking through the y axis, we can observe planar and conical nodes symmetrical about z axis (category [B]). The patterns of these nodes are symbolically shown in Fig. 7(b) [16]. The orbital at the top of each column has no node of category [B] as is represented none in Fig. 7(b). The number of nodes of category [B] increases one by one as the value of n increases, and decreases one by one as the value of $|m|$ increases.

Total number of atomic orbitals for values of principal quantum number n from 1 to 6 is 91, as is calculated from Table 1 $(1+4+9+16+25+36 = 91)$. In these, $55 (91-36)$ orbitals have spherical node(s).

7.   Planar Nodes Containing z axis (Category [C])

Figure 8(a) shows 36 sculptured cubes in Fig. 7(a) turned 180 degrees around z axis and 90 degrees around x axis. Looking through the z axis, we can observe planar nodes containing z axis (category [C]). The orbital at the top of Figs. 7(a) and 8(a) is a 1s orbital. As s orbitals have spherical symmetry, the shapes of these two pictures are identical. In the second rows, 2p (y), 2p (z), and 2p (x) orbitals are shown. Comparing Fig. 7(a) with Fig. 8(a), these three orbitals have the same shapes having different direction of nodal planes.

The number of planar nodes containing z axis (category [C]) is the absolute of magnetic quantum number $|m|$ (Table 2). For example, the value of magnetic quantum number m of 1s or 2p (z) orbital is 0, each orbital has no planar nodes containing z axis as is shown as none in Fig. 8(b).