was that they were common refrigerator magnets and they were glued down with their poles all oriented in the same direction. The "N" indicated that all the N poles were pointing upward, although that is not an important issue regarding how the system works. In a few cases the gluing issue was addressed: unless the magnets are glued down they immediately clump up, due to the attraction between their various poles, and will not lie flat. This is actually an extremely important feature rarely discussed in textbooks: magnets are not held together just by the magnetic fields of their component structures (e.g., "domains").

Once the magnet situation was understood it was usually deduced that there must be a largely vertical magnetic field penetrating through the solution.

The examiner rather expected that the students would be knowledgeable about the blue tint of the solution, but students nowadays seem to have had less exposure to chemistry and thus are not aware that copper sulphate is the only common salt giving a blue solution. At all events, the examiner would volunteer this information and mention that its presence made the ordinary distilled water it was dissolved in electrically conducting (unlike distilled water itself). Because it was not an important issue for understanding how the solution rotated, it was only occasionally pointed out that the reason copper sulphate was used instead of ordinary salt, or any other salt, was to minimize the electrolytic interactions between the copper electrodes and the conducting solution.

The next step in understanding the liquid cyclotron was for the students to make use of the force equation:

$$\mathbf{F} = q(\mathbf{E} + \mathbf{v} \times \mathbf{B})$$

Where **F** is the force on charge q, **E** is the electric field, **v** is the charge velocity, and **B** is the magnetic field. Obviously **E** will be radially directed and, with a little more thought, strongest near the central electrode. With the resulting v's of the charge carriers all radially directed, the **v x B** forces will lead to circular motion – in the same direction for both positive and negative charges. The rate of circular motion will be strongest near the central electrode. Finally, interaction (collisions) between the charge carriers and neutral particles will produce circular motion of the fluid itself. Reversing the voltage supply will reverse the direction of **E** and thus reverse the direction of motion of the fluid.

There are a few tricky points in comparing this liquid cyclotron with the conventional cyclotron discussed in, say, physics classes describing particle accelerators. In particular, there are both positive and negative charges being driven around inside the region of magnetic field, and then there are their interactions with the neutral fluid, making the circular motion of the charged particles visible but also slowing it down.