1. Define isotonicity and explain its significance in ophthalmic and parenteral pharmaceutical formulations. Provide examples of commonly used isotonic solutions and their roles.
2. Compare and contrast the physiological effects of hypotonic, hypertonic, and isotonic solutions when administered via ocular or parenteral routes. What consequences can arise from using a non-isotonic formulation?
3. Describe the formulation challenges associated with maintaining isotonicity in parenteral products. How can excipients like buffers and preservatives affect osmolarity and what are the regulatory considerations in this context?
4. Illustrate with suitable examples how isotonicity influences patient comfort and therapeutic efficacy in ophthalmic applications. What are the risks of using non-isotonic eye drops?
5. Evaluate emerging strategies and future trends in achieving isotonicity in novel dosage forms such as smart contact lenses or personalized IV fluids. How might these innovations improve current clinical outcomes?