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# Exercise 9 DIFFUSION AND OSMOSIS: PASSIVE MOVEMENT OF MOLECULES IN BIOLOGICAL SYSTEMS

This exercise expands the definition of diffusion to include the concept of free energy. However, many students find this concept difficult to understand. They will need some help interpreting their results in terms of free energy rather than just concentration. Also important is the concept of a "model" in biological investigation. Specifically, the dialysis bag is used as a model of a cell.

If time permits, use this exercise to discuss aspects of experimentation such as hypotheses, quantification, sources of error, design of graphs, and individual versus class results.

#### SUGGESTED ELEMENTS FOR AN INTRODUCTORY LECTURE

- Heat causes molecules to move randomly and drives diffusion.
- Brownian movement is the random movements of small particles caused by collisions with other small particles.
- Diffusion is the net movement of molecules from an area of high free energy to an area of low free energy.
- · Free energy is the energy available to do work.
- Osmosis is the diffusion of water across a differentially permeable membrane.
- A solvent is a fluid that dissolves substances. A solute is a substance dissolved in a solution.
- A hypotonic solution has a salt concentration lower than the concentration of a comparable solution.
- A hypertonic solution has a salt concentration higher than the concentration of a comparable solution.

## **Vodopich Lab Manual Answers**

**Cummings** 

#### **Vodopich Lab Manual Answers:**

**Biology Laboratory Manual** Darrell S. Vodopich, Moore, 1989 Biology Peter H. Raven, 1999 2000 2005 State Textbook Adoption Rowan Salisbury Active Learning in College Science Joel J. Mintzes, Emily M. Walter, 2020-02-23 This book explores evidence based practice in college science teaching It is grounded in disciplinary education research by practicing scientists who have chosen to take Wieman s 2014 challenge seriously and to investigate claims about the efficacy of alternative strategies in college science teaching In editing this book we have chosen to showcase outstanding cases of exemplary practice supported by solid evidence and to include practitioners who offer models of teaching and learning that meet the high standards of the scientific disciplines Our intention is to let these distinguished scientists speak for themselves and to offer authentic guidance to those who seek models of excellence Our primary audience consists of the thousands of dedicated faculty and graduate students who teach undergraduate science at community and technical colleges 4 year liberal arts institutions comprehensive regional campuses and flagship research universities In keeping with Wieman's challenge our primary focus has been on identifying classroom practices that encourage and support meaningful learning and conceptual understanding in the natural sciences The content is structured as follows after an Introduction based on Constructivist Learning Theory Section I the practices we explore are Eliciting Ideas and Encouraging Reflection Section II Using Clickers to Engage Students Section III Supporting Peer Interaction through Small Group Activities Section IV Restructuring Curriculum and Instruction Section V Rethinking the Physical Environment Section VI Enhancing Understanding with Technology Section VII and Assessing Understanding Section VIII The book s final section IX is devoted to Professional Issues facing college and university faculty who choose to adopt active learning in their courses The common feature underlying all of the strategies described in this book is their emphasis on actively engaging students who seek to make sense of natural objects and events Many of the strategies we highlight emerge from a constructivist view of learning that has gained widespread acceptance in recent years In this view learners make sense of the world by forging connections between new ideas and those that are part of their existing knowledge base For most students that knowledge base is riddled with a host of na ve notions misconceptions and alternative conceptions they have acquired throughout their lives To a considerable extent the job of the teacher is to coax out these ideas to help students understand how their ideas differ from the scientifically accepted view to assist as students restructure and reconcile their newly acquired knowledge and to provide opportunities for students to evaluate what they have learned and apply it in novel circumstances Clearly this prescription demands far more than most college and university scientists have been prepared for Forthcoming Books Rose Arny, 1997

**Books in Print**, 1994 Books In Print 2004-2005 Ed Bowker Staff, Staff Bowker, Ed, 2004 Medical and Health Care Books and Serials in Print, 1987 **Selected Labs from Biology Laboratory Manual** Darrell S. Vodopich, Randy Moore, 2005 Workbook Lab Manual W/Answer Key Cummings, 1998-09-01 **Whitaker's Book List**, 1991

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