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Dental Admission Test

General Chemistry Readiness Survey

This report describes the results of the most recent General Chemistry Readiness Survey.

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General Chemistry Readiness Surveys: Establishing the Content Domain and Test Specifications for the General Chemistry Section of the Dental Admission Test (2020)

Background

In 2020, at the direction of the American Dental Association's (ADA's) Council on Dental Education and Licensure (CDEL), the ADA's Department of Testing Services (DTS) initiated activities to update and establish the content domain and test specifications for the general chemistry section of the Dental Admission Test (DAT). This effort relied heavily on the expertise of general chemistry subject matter experts serving on the DAT General Chemistry Test Construction Team (TCT), working closely with DTS staff to specify relevant content areas for possible inclusion in the general chemistry test section. Three surveys were conducted to inform the general chemistry section updates. Survey data collection took place during the fall and winter of 2020-2021. Findings were reviewed and interpreted by the General Chemistry TCT, DTS staff, and CDEL's Dental Admission Testing Committee (DATC), with final review and approval of proposed changes by CDEL occurring in May of 2021. Revisions to the DAT are expected to be implemented in 2023. This document summarizes information concerning the implementation of the surveys and the overall findings of this effort.

Approach

Three ***General Chemistry Readiness*** surveys were developed to identify core knowledge in general chemistry that first-year U.S. dental students must know when entering dental school, in order to be adequately prepared to benefit from further training. "Core knowledge" refers to required knowledge that establishes readiness for dental school training. Incoming dental students who possess the knowledge prerequisites are ready to face the challenges associated with their first year in dental school, while those who lack the required knowledge are unlikely to be successful unless they revisit and learn the fundamentals. Updates to the DAT general chemistry section should therefore reflect current general chemistry core knowledge requirements in order to effectively assess students' readiness for dental school training.

The surveys targeted three distinct populations: pre-health general chemistry instructors, faculty who teach first-year dental students, and current dental students. It was reasoned that insights from each of these groups would allow the General Chemistry TCT to compare information that dental schools require first-year dental students to know with information that pre-dental programs teach candidates. Survey results could then be used to identify areas of commonality and discrepancy between pre-dental instruction, dental school requirements, and the DAT general chemistry content outline. Moreover, the surveys could begin the process of identifying specific pieces of core knowledge in each topic area within the DAT general chemistry section, providing valuable information for item development purposes.

Survey of Pre-Health General Chemistry Instructors

Recruitment & Sample

Survey invitations were emailed to health professions advisors at colleges and universities in the United States, via the National Association of Advisors for the Health Professions (NAAHP) listserv. Email recipients were told that participation in the survey would help inform admission decisions and the development of examinations measuring knowledge of important topics and concepts in general chemistry. The final sample consisted of responses from 29 universities evenly distributed across the United States. A majority of respondents were professors, with an average of 15.7 years of experience as introductory/general chemistry instructors. All respondents worked at four-year universities, and most held a Ph.D. in general chemistry.

Survey Items

Respondents were asked to indicate the percentage of course time allocated to various general chemistry topics, first focusing on main general chemistry topics, and then focusing on the subtopics associated with each main topic. As respondents indicated time allocations, the survey automatically totaled the percentages so that the total time allocation did not exceed 100%. Afterwards, respondents were given an opportunity to list any topics or subtopics they thought should be removed from or added to the general chemistry section of the DAT, in open-ended responses.

Example:

Survey of Faculty who Teach First-Year Dental Students

Recruitment & Sample

Survey invitations were distributed via email to dental school deans, with the request that the survey be forwarded to first-year dental faculty who were well-acquainted with the depth and breadth of the first-year curriculum. Email recipients were told that participation in the survey would help inform the development of examinations that help dental schools identify candidates with the highest potential for success in dental school. The final sample consisted of 33 respondents from universities evenly distributed across the United States. Respondents had an average of 20.5 years of experience as dental school instructors. Most respondents held either D.M.D/D.D.S degrees or Ph.Ds.

Survey Items

Respondents were asked to rate the importance of various main topic and sub-topic areas covered in the general chemistry section of the Dental Admission Test (DAT), using Likert response scales (1=*Not Important*; 5=*Extremely Important*). Afterwards, respondents were given an opportunity to list any topics or subtopics they thought should be removed or added to the general chemistry section of the DAT, in open-ended responses.

Example:

How important is knowledge in each main topic area, for incoming students to be ready to meet the challenges of your dental school curriculum?

	Not Important	Somewhat Important	Moderately Important	Very Important	Extremely Important	Unable to Rate
Stoichiometry and General Concepts	○	○	○	○	○	○
Gases	○	○	○	○	○	○
Liquids and Solids	○	○	○	○	○	○
Solutions	○	○	○	○	○	○
Acids & Bases	○	○	○	○	○	○
Chemical Equilibria	○	○	○	○	○	○
Thermodynamics and Thermochemistry	○	○	○	○	○	○
Chemical Kinetics	○	○	○	○	○	○
Oxidation-Reduction Reactions	○	○	○	○	○	○
Atomic and Molecular Structure	○	○	○	○	○	○
Periodic Properties	○	○	○	○	○	○
Nuclear Reactions	○	○	○	○	○	○
Laboratory	○	○	○	○	○	○
Other (Please briefly describe):	○	○	○	○	○	○

Survey of Current Dental Students

Recruitment & Sample

Survey invitations were emailed to a random sample of dental students in their third year of study at a CODA-accredited school, which was approximated by contacting those who completed the DAT in 2016 or 2017, and confirmed through responses to survey screener questions. Email recipients were told that participation in the survey would help identify knowledge that a first-year dental student must know when entering dental school in order to be adequately prepared to benefit from further training. The final sample consisted of 47 respondents. Demographic information was not collected.

Survey Items

Respondents were randomly assigned one subtopic within each of 13 main topic areas covered in the DAT. For each assigned subtopic, respondents were asked to provide an example of core knowledge that reflects the most detailed or complicated piece of information or concept that a student must know in that subtopic area, in order to be considered ready for training that could be provided anytime in the first year of dental school. Responses were open-ended.

Example:

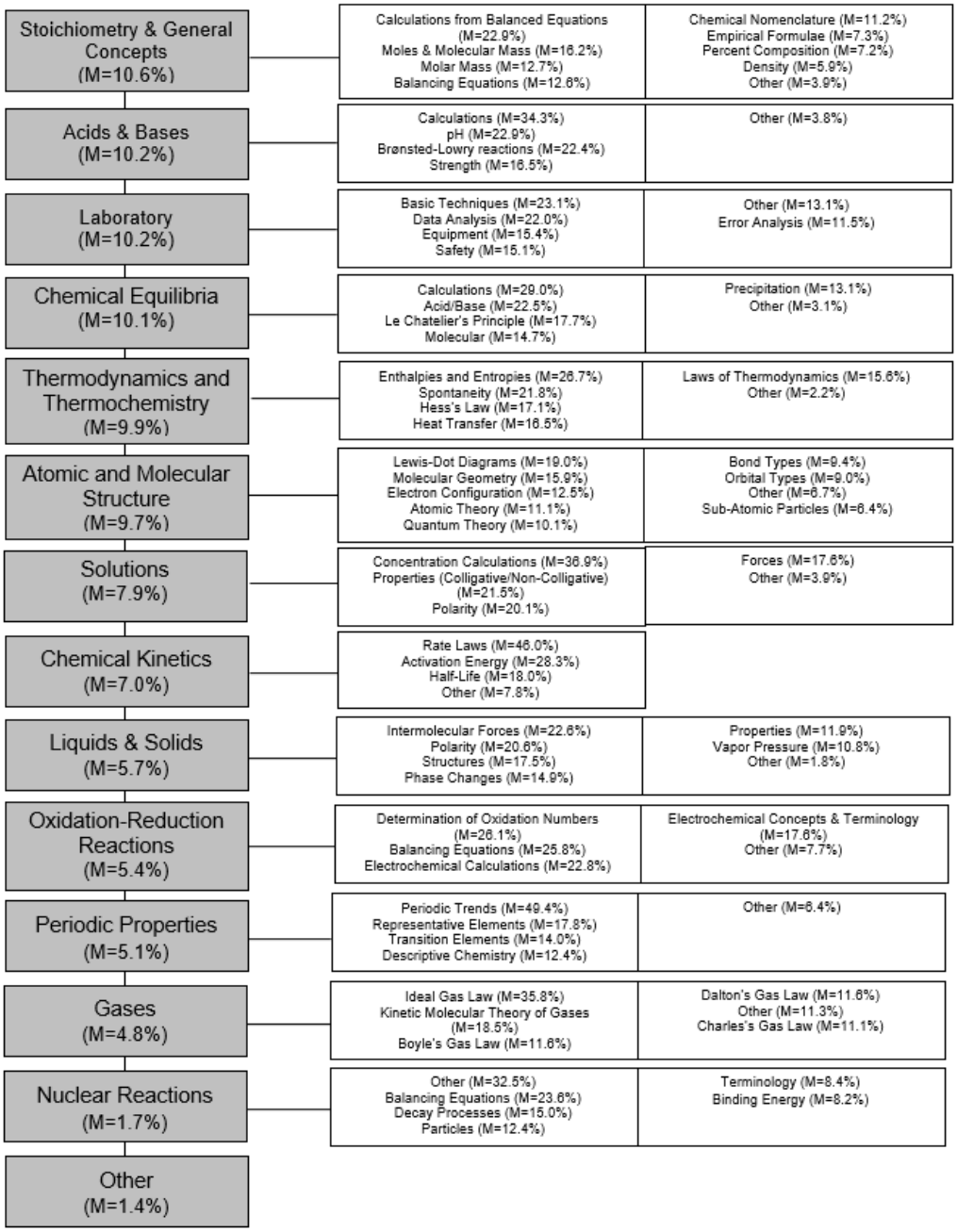
> Your **Atomic and Molecular Structure** subtopic is **Sub-Atomic Particles.**
>
> Please provide an example of core knowledge that reflects the most detailed or complicated piece of information or concept that a student must know in **Sub-Atomic Particles,** in order to be considered ready for training that could be provided anytime in the first year of dental school.

Survey Results

Survey of Pre-Health General Chemistry Instructors

Table 1 presents the mean percentage of time pre-health general chemistry instructors report allocating to each general chemistry main topic and subtopic area. Topics are listed based on mean scores (descending order). If mean scores are equal, topics are listed alphabetically.

Table 1. Time Allocations (Survey of Pre-Health General Chemistry Instructors)



Survey of Faculty who Teach First-Year Dental Students

Table 2 presents the mean importance ratings for each main topic and subtopic area, as indicated by faculty who teach first-year dental students. Topics are listed based on mean scores (descending order). If mean scores are equal, topics are listed alphabetically.

Table 2. Topic Importance Ratings (Survey of Faculty who Teach First-Year Dental Students)

Acids & Bases (M=4.2)	pH (M=4.5) Strength (M=4.2) Calculations (M=3.5) Brønsted-Lowry Reactions (M=3.1)	
Solutions (M=3.8)	Concentration Calculations (M=3.7) Forces (M=3.5) Polarity (M=3.5) Properties (M=3.0)	
Chemical Equilibria (M=3.7)	Acid/Base (M=4.1) Molecular (M=3.6) Precipitation (M=3.5) Calculations (M=3.3)	Le Chatelier's Principle (M=2.5)
Liquids and Solids (M=3.7)	Properties (M=3.7) Polarity (M=3.6) Intermolecular Forces (M=3.5) Structures (M=3.5)	Phase Changes (M=3.4) Vapor Pressure (M=3.2)
Oxidation-Reduction Reactions (M=3.7)	Balancing Equations (M=3.1) Electrochemical Concepts & Terms (M=3.0) Determination of Oxidation #s (M=2.9) Electrochemical Calculations (M=2.6)	
Stoichiometry and General Concepts (M=3.6)	Chemical Nomenclature (M=4.0) Density (M=3.6) Moles & Molecular Formulas (M=3.5) Percent Composition (M=3.4)	Balancing Equations (M=3.2) Calculations f/ Balanced Equations (M=3.1) Empirical Formulae (M=3.0) Molar Mass (M=2.9)
Atomic and Molecular Structure (M=3.5)	Bond Types (M=3.8) Electron Configuration (M=2.9) Molecular Geometry (M=2.8) Atomic Theory (M=2.7)	Orbital Types (M=2.5) Quantum Theory (M=2.2) Sub-Atomic Particles (M=2.2) Lewis-Dot Diagrams (M=2.0)
Chemical Kinetics (M=3.4)	Half-Life (M=3.9) Activation Energy (M=3.4) Rate Laws (M=3.2)	
Gases (M=3.3)	Ideal Gas Law (M=3.0) Kinetic Molecular Theory of Gases (M=3.0) Boyle's Gas Law (M=2.9) Dalton's Gas Law (M=2.9)	Charles's Gas Law (M=2.8)
Laboratory (M=3.3)	Safety (M=4.1) Data Analysis (M=4.0) Basic Techniques (M=3.6) Error Analysis (M=3.5)	Equipment (M=3.2)
Thermodynamics and Thermochemistry (M=3.3)	Laws of Thermodynamics (M=3.4) Heat Transfer (M=3.3) Enthalpies and Entropies (M=2.9) Spontaneity (M=2.5)	Hess's Law (M=2.3)
Periodic Properties (M=3.1)	Descriptive Chemistry (M=3.1) Representative Elements (M=3.1) Periodic Trends (M=2.9) Transition Elements (M=2.8)	
Nuclear Reactions (M=2.4)	Terminology (M=3.1) Particles (M=2.8) Binding Energy (M=2.7) Decay Processes (M=2.7)	Balancing Equations (M=2.4)

Survey of Current Dental Students

The survey of current dental students was conducted to provide DAT General Chemistry TCT members with information that could be used in writing DAT examination items. As such, the content is considered secure and extremely confidential. Due to the secure nature of this material, responses are not provided in the present summary.

Revisions to DAT General Chemistry Test Specifications

Survey findings were reviewed and interpreted by the General Chemistry TCT, DTS staff, and CDEL's Dental Admission Testing Committee (DATC). Based on the findings, changes to the general chemistry test specifications of the DAT were recommended and approved by CDEL. Changes to the general chemistry test specifications will be shared with communities of interest prior to their implementation, which is expected to occur in 2023.