



Medford Public School
ISD #763

TO: Medford Board of Education

FROM: Christopher J. Ovrebo, Principal

DATE: March 11, 2015

RE: Food Chemistry Proposal

Proposed change to graduation requirements: Offer one section of Food Chemistry through the agricultural education department to satisfy the chemistry graduation requirement. This will require the board to change the local graduation policy (613) at the April board meeting.

Proposed Course Description:

Food Chemistry

Prerequisite: None

Grades: 10, 11

This course is designed to help students learn about the relationships among science, food, and nutrition. Basic laws of chemistry, microbiology, and physics are applied to the production, processing, preservation and packaging of food. Students will conduct hands-on experiments that apply chemical principles and basic lab techniques needed for success in post-secondary courses. This course explains how water, carbohydrates, lipids, proteins, vitamins, and minerals react in foods; biochemical and functional properties, enzymes, food additives (emulsifiers, pigments, colors, flavors, preservatives, and sweeteners) and texture as related to properties in food systems and during processing. Student will also be introduced to food science through product development. As related to food chemistry, this course will also look into soil chemistry and how it relates to food production and biofuel chemistry with food crops. This course will be held two consecutive hours during the semester, meeting the requirement for Chemistry as 1 science credit.



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FOOD CHEMISTRY COURSE OUTLINE

UNIT 1: Elements and the Periodic Table

- LAB

UNIT 2: Formation and Structure of Chemical Compounds

- Food analogues
- Fat replacers
- Fresh vs. cooked foods

UNIT 3: Interpretation and Manipulation of Chemical Formulas

- Food additives
- Physical properties/qualities of food
- Chemical changes in food

UNIT 4: Organic Chemistry – Molecules of Life

- Food nutrient analysis (Big Mac Lab)
- Micronutrients (Vitamins & Minerals)
- Thermal presentation (hot/cold processing)
- Light meat vs. dark meat
- Protein foams
- Nutrient breakdown during digestion

UNIT 5: Solutions and Solubility

- Emulsifiers
- Mixtures/suspensions
- Homogenization
- Caffeine
- Vitamin C titration

UNIT 6: Chemical Reactions

- Shelf Life
- Contaminants
- Dairy food science
- Fermentation & esterification
- Bread-making
- Red meat (new vs. aged)

UNIT 7: Stoichiometry

UNIT 8: Reaction Rates and Equilibrium

- Enzymes in food
- Coagulation
- Cheese-making
- Tomato soup
- Enzymatic browning
- Catalase in potatoes
- Proteolytic enzymes in fruit
- Canned vs. fresh fruits
- Meat tenderizers
- Enzymes and insulin production

UNIT 9: Acids and Bases

- Microcomponents – Phytochemicals
- Fruit maturity
- Cakes and pH
- Eggs and pH
- Batters & doughs

UNIT 10: Phases Changes and Properties of Matter

- Mechanical and chemical methods of separation
- Emulsifiers
- Dehydration and concentration
- Ice cream making lab

UNIT 11: Biological Aspects of Food Chemistry

- Food Safety
- Food-borne illness
- Spoilage
- GMO Lab (NDSCS)
- Trends in preservation, irradiation, and biotechnology

UNIT 12: Trends in Food Science

- Farm food safety vs. processing vs. home food safety
- Food labeling laws & trace-backs
- Worldwide food standards
- Research and development in new food products
- Careers in food science & chemistry



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MN Chemistry Standards Alignment

9C.1.3.3.1

- ALL THROUGHOUT THE YEAR!

9C.1.3.4.1

- A Natural Approach to Chemistry BOOK (Chapter 1)

9C.2.1.1.1

- Food Chemistry BOOK (Chapter 4)
- Elements and the Periodic Table LAB
- Cover atomic numbers & electron configuration
- A Natural Approach to Chemistry BOOK (Chapter 5)

9C.2.1.1.2

- Families of Elements LAB
- A Natural Approach to Chemistry BOOK (Chapter 6)

9C.2.1.2.1

- Food Chemistry Book (Chapter 4)
- A Natural Approach to Chemistry BOOK (Chapter 7)

9C.2.1.2.2

- Molecules of Life LAB
- Chemistry of Carbohydrates LAB (Food Chemistry – Chapters 8 & 9)
- Chemistry of Fats LAB (Food Chemistry – Chapter 10)
- Chemistry of Proteins LAB (Food Chemistry – Chapter 11)

9C.2.1.2.3

- Food Chemistry BOOK (Chapter 4)
- A Natural Approach to Chemistry BOOK (Chapter 8)
- Determination of Chemical Formulas LAB

9C.2.1.2.4

- A Natural Approach to Chemistry BOOK (Chapter 1)
- Plus ADDITIONALS

9C.2.1.2.5

- A Natural Approach to Chemistry BOOK (Chapter 8)
- Plus ADDITIONALS

9C.2.1.2.6

- Food Chemistry BOOK (Chapter 4 & 7)
- A Natural Approach to Chemistry BOOK (Chapter 9)

9C.2.1.2.7

- Food Chemistry BOOK (Chapter 4)
- A Natural Approach to Chemistry BOOK (Chapter 9)
- Make-A-Gas Carbon Dioxide Kit

9C.2.1.3.1

- A Natural Approach to Chemistry BOOK (Chapter 10)
- Identification of Chemical Reactions LAB

9C.2.1.3.2

- Identification of Chemical Reactions LAB
- A Natural Approach to Chemistry BOOK (Chapter 10)
- Introduction to Oxidation-Reduction LAB kit
- Preventing Oxidation LAB (No More Brown Bananas)

9C.2.1.3.4

- A Natural Approach to Chemistry BOOK (Chapter 10)
- Food Chemistry BOOK (Chapter 4)



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- 9C.2.1.3.3
- Introduction to pH measurement LAB
 - A Natural Approach to Chemistry BOOK (Chapter 13)
 - Food Chemistry BOOK (Chapter 6)
- 9C.2.1.3.5
- A Natural Approach to Chemistry BOOK (Chapter 11)
- 9C.2.1.3.6
- LAB AIDS (Volume 2)
 - A Natural Approach to Chemistry BOOK (Chapter 12)
 - Food Chemistry BOOK (Chapter 12)
- 9C.2.1.3.7
- Modeling Chemical Equilibrium LAB
 - Changing of Equilibrium – Le Chatelier’s Principle LAB
- 9C.2.1.4.1
- Food Chemistry BOOK (Chapter 5)
 - A Natural Approach to Chemistry BOOK (Chapter 14)
- 9C.2.1.4.2
- Food Chemistry BOOK (Chapter 5)
 - A Natural Approach to Chemistry BOOK (Chapter 14)
- ALSO TO COVER:**
- Food safety (Chapter 18 in Food Chemistry book)
 - Food-borne illness
 - Spoilage
 - Shelf Life
 - Contaminants
 - Farm food safety vs. processing vs. home food safety
 - Food labeling laws & trace-backs
 - Food additives
- Food nutrient analysis (Big Mac LAB)
 - Vitamin C Titration
 - Micronutrients – Vitamins & Minerals (Chapter 13 in Food Chemistry Book)
 - Microcomponents – Phytochemicals
 - Worldwide food standards
 - Food analogues (Rice, soy, margarine, salt substitutes, etc.)
 - Taste tests
 - Ice-cream making
 - Fat replacers
 - Caffeine
 - Emulsifiers
 - Fermentation
 - Make bread
 - Thermal presentation (hot & cold processing)
 - Dehydration & concentration (Chapter 20 in Food Chemistry book)
 - Trends in food preservation, irradiation, preservation, and biotechnology
 - GMO Lab (NDSCS)
 - Mechanical & Chemical methods of separation
 - Nutrient breakdown during digestion
 - Research and development in new food products
 - Careers in food science & chemistry



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Statutory Reference

120B.024 CREDITS.

Subdivision 1. Graduation requirements. Students beginning 9th grade in the 2011-2012 school year and later must successfully complete the following high school level credits for graduation:

- (1) four credits of language arts sufficient to satisfy all of the academic standards in English language arts;
- (2) three credits of mathematics, including an algebra II credit or its equivalent, sufficient to satisfy all of the academic standards in mathematics;
- (3) an algebra I credit by the end of 8th grade sufficient to satisfy all of the 8th grade standards in mathematics;
- (4) **three credits of science, including at least one credit of biology, one credit of chemistry or physics, and one elective credit of science. The combination of credits under this clause must be sufficient to satisfy (i) all of the academic standards in either chemistry or physics and (ii) all other academic standards in science;**
- (5) three and one-half credits of social studies, encompassing at least United States history, geography, government and citizenship, world history, and economics sufficient to satisfy all of the academic standards in social studies;
- (6) one credit of the arts sufficient to satisfy all of the state or local academic standards in the arts; and
- (7) a minimum of seven elective credits.

Subd. 2. Credit equivalencies. (a) A one-half credit of economics taught in a school's agriculture education or business department may fulfill a one-half credit in social studies under subdivision 1, clause (5), if the credit is sufficient to satisfy all of the academic standards in economics.

(b) An agriculture science or career and technical education credit may fulfill the credit in chemistry or physics or the elective science credit required under subdivision 1, clause (4), if the credit meets the state chemistry or physics, or district biology academic standards or a combination of these academic standards as approved by the district. A student must satisfy either all of the chemistry academic standards or all of the physics academic standards prior to graduation. An agriculture science or career and technical education credit may not fulfill the required biology credit under subdivision 1, clause (4).

(c) A career and technical education credit may fulfill a mathematics or arts credit requirement under subdivision 1, clause (2) or (6).

(d) An agriculture education teacher is not required to meet the requirements of Minnesota Rules, part 3505.1150, subpart 1, item B, to meet the credit equivalency requirements of paragraph (b) above.

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