

Glassboro Public Schools



MEMO

To: Dr. Mark Silverstein, Superintendent of Schools

From: Dr. Robert Preston, Chief Academic Officer

Date: January 26, 2023

Re: Action Memo
February 22, 2023 Board Meeting

Recommend Board approve submission of the Glassboro Education Foundation Grant award for the 2022-2023 school year.

“Advancing Science, Technology, Engineering, Arts & Mathematics (S.T.E.A.M.) Education from Glassboro’s Classrooms to the Real World”/Glassboro High School/Joseph Bell and Susan Powers/\$4176.29

Glassboro Education Foundation, Inc.

Send the completed application to the attention of:

Dr. Robert Preston
Beach Administration Building
Joseph L. Bowe Blvd
Glassboro, NJ 08028

A. General Information

Applicant(s): Dr. Joseph Bell and Mrs. Susan Powers
School: Glassboro High School
Principal: Dr. Monique Stowman-Burke
Grade Level or Subject: 9-12
Phone: (school) 856-652-2700x1101 (Home) 856-298-3213 (Bell)
E-mail(s): jbell@gpsd.us and spowers@gpsd.us

B. Statement of Assurances:

The applicant hereby assures the Glassboro Education Foundation that:

1. The applicant(s) meet(s) the eligibility criteria.
2. The activities and services for which the grant is sought will be implemented as written.
3. Any monies not expended within the school year shall revert back to the Glassboro Education Foundation, unless permission to carry it into the next school year is granted.
4. All publicity releases regarding a funded project will acknowledge the Glassboro Education Foundation and/or a particular mini-grant sponsor as the funding agency.
5. The grant recipient(s) will submit a final report summarizing the project's evaluation results.
6. The Board of Education authorizes the filing of this application.

We do hereby certify that all of the facts, figures and representations made in this application are true and correct to the best of our knowledge and that the assurances as stated above are understood and will be followed in their entirety.

Susan Powers

Signature of Applicant

Monique-Burke

Signature of Principal

Joseph Bell

Signature of Applicant

1-4-2023

Date

Please note: from this page on, please do not include your name or your school in any of your descriptions as all applications are coded to prevent bias.

C. Project Title and Description

Title of Project: *Advancing Science, Technology, Engineering, Arts & Mathematics (S.T.E.A.M.) Education from Glassboro's Classrooms to the Real World*

Subject Area(s): _____ Chemistry, Physics & Biology _____

Approximate Number of Students Participating: _____ 100 _____

Project Starting Date: 12 September 2023 Project Completion Date: 16 June 2024

Need: Describe the problem or deficiencies that exist which require the improvements described.

The goal of the 2022-23 GEA Science Grant is to address a vital challenge in the Glassboro Public School District (GPSD) and Glassboro High School (GHS) is "How can all students learn significant Science, Technology, Arts, Engineering and Mathematics (STEAM) content? The science grant focuses on elevating the science curriculums, lessons and concepts critically affected and too often, inhibited at the high school level. The science grant will provide scientific instrumentation and materials as invaluable tools to assist teachers and students and thus, secondarily address GHS educators' quest in "How can classroom science teachers better teach STEAM content?

In spite of a proposed general Glassboro district referendum, the referendum unfortunately, will not address longstanding science department equipment or instrumentation currently plaguing all the science classrooms, particularly those (i.e., A-107, A-131, A-132, A-137, A-139 & A-140) primarily designed for classroom teaching due to the lack of updated scientific circuitry, equipment, benchtops or ventilation. Notwithstanding, the ongoing

lack of space and discrepancies in classroom features and growing class sizes, directly impacts the scientific and laboratory lessons, experimentation and ultimately, student achievement and advances in STEAM education. To best remedy the shortcomings in classroom design, equipment and logistics and the impact they have on curriculum and lesson plan design and implementation, the science teachers (i.e., biology, chemistry & physics) have disproportionately relied on either virtual or teacher demos to convey concepts and experimentation. Although virtual and teacher demos have their value, the reliance on such practices deny students the tactile, physical and/or experimental acuity critical for higher order thinking and reasoning. Additionally, the growing reliance on virtual and demo labs due to the lack of scientific equipment and material greatly impedes but all too often, inhibits student-led inquiry at all grade levels.

To address the challenge of "How can classroom science teachers better teach STEAM content?", this grant proposal seeks to elevate the Next Generation Science Standards (NGSS) based STEAM curriculum and lessons by acquiring equipment and materials to enhance student laboratory experimentation, skills/skill sets and inquiry in all grade levels and notable and recognized GHS science clubs/academies (i.e., Biomedical Club, STEM Academy).

Strategy: Briefly describe your plan to alleviate the need/problem.

I fully plan to include these models in my regular chemistry class as we discuss topic like:

- Chemical reactions & stoichiometry
- The formation of solutions and solution concentrations (pH, molarity & molality)
- The formation of covalent molecules & ionic compounds
- The formation and structure of common everyday compounds
- The formation of organic molecules and structure
- Electromagnetic Radiation Spectral properties & analyzes
- Modeling of Electromagnetic Radiation & Waves
- Genetic & medicinal molecules (i.e., DNA, RNA, insulin, ibuprofen/aspirin) analyzes
- Analyses of biological micro- & macroscopic molecules

These are just some of the subjects and shared scientific ideas and concepts in chemistry and biology that will be affected by the awarding of the grant. From upper level AP chemistry down to the struggling student who just can't seem to understand, the scientific equipment will have a huge impact on understanding and remediation of science misconceptions. In terms of the future, the equipment and material requests of this grant are based on the current biology, chemistry & physics science curricula and the means to jointly alleviate critical deficiencies that negatively impact curriculum design, implementation and student achievement in all grades and scientific activities. Departmentally, the grant provides a portable water purification & deionization system; analytical and scientific balances critical for physics, biology and all levels of chemistry and Advanced Placement(AP) courses; element electrodes/spectrum tubes for electromagnetic spectrum analyses in physics & all chemistry courses, spectrophotometer for measuring concentrations for solution based chemistry and electrophoresis system for biological studies and science clubs and activities. Collectively, the grant provides invaluable tools to best 'teach' and 'make real" general and complex scientific concepts through 'hands-on' practices for all students. By awarding this grant, the science department at Glassboro high school will be at the forefront of STEAM teaching and education to all students. Besides the classroom, another benefit of this grant is its impact on after school science clubs and academies. Currently, Glassboro high school is home to several highly recognized science clubs/academies - the Biomedical Club and STEM academy and a 2022-23 proposed science

club. In collaboration with Rowan University, the Biomedical Club and STEM academy offer students collegiate and advanced science preparation and experimentation. Presently, these organizations lack the equipment and materials which greatly limits their scientific effectiveness and most importantly, attractiveness to new or potential members. Collectively, these clubs/academies provide a "real world" supplement to in class science curriculum and teaching.

Lastly, all of my co-teachers are so excited about the potential and ramifications of this grant in enriching student science learning and experience. As science educators at Glassboro high school, our foremost endeavor is to provide the highest conceptual, experimental and student inquiry-based NGSS education that will 'expand and refine' student thinking and experiences , so that they may best 'define' their futures.

Outcomes

There have been extensive amounts of research done about student learning styles. As teachers, we realize that not all students respond to traditional verbal lectures, paper-based diagrams or online modeling programs. As science educators, we assert that placing proper equipment, materials and apparatuses in the hands of a student takes a chemical concept from the abstract to the understandable. Throughout our chemistry and biology class, students say that they like to 'touch' things in front of them that they would otherwise have to imagine or visualize. They also enjoy breaking away from the traditional means of learning to manipulate something other than their pencils. Similar to the various 'cookware' in a kitchen, a science class devoid of its 'science ware' limits the training, creativity and worst, student inquiry. Another benefit of the grant is improving student learning by providing a means of communicating in a meaningful way with my English-language learners, as well as low performing students. In class, we have witnessed an increase in interest and understanding among ESL and low performing students as we have worked to include more models and experimentation in science classrooms. And as the population of underrepresented students, many with

standard science proficiency, continues to increase at Glassboro, the imperativeness of science teachers possessing the proper materials, instruments and "science ware" to impart the highest level of education can not be overlooked nor overemphasized. In addition, we also predict the presence of the awarded equipment and materials to elevate teacher performance, by more effectively syncing the lesson planning and laboratory experiences for all students. As a means of measuring progress, each teacher plans on comparing this year's biology, chemistry and AP labs and subject tests to the scores next year. More importantly, we hope to see a decrease in the amount of remediation and tutoring required for some of my more difficult topics. In addition to measuring student performance in the various disciplines, we contend that the awarding of the grant will significantly increase student enrollment in the science clubs/academies.

Lastly, this grant will provide a solid foundation to the continued individual and departmental mission of educating the students of Glassboro at the highest levels. As teachers

of Glassboro high school, we will also continue to be the vanguards of student education and for the empowerment of their futures.

Glassboro Education Foundation

Grant Application

D. Objectives, Activities and Evaluation Techniques (This page may be duplicated if necessary)

- Listed below are several chemistry topics and concepts that will be covered during the 2022-23 school year but where student acuity and scoring and achievement would be immeasurably enhanced by the awarding of the grant.
- Given that success in chemistry is based on student comprehension and expression of the transition of atoms from simple to complex compounds/molecules and the effect on their electronic properties.
- All Units topics are accompanied by Next Generation Science Standards (NGSS).

Objectives	Program Activities to Accomplish Objectives	Completion Date	Evaluation Techniques
Unit: Flame Test - Spectral Analysis of Ions & Elements <ul style="list-style-type: none"> Obj: These investigations provide students with the opportunity to connect energy and matter at the microscale from macroscale observations by identifying the presence of various metals in solution. The goals of this lab are to give students a way/method to interact with atoms and electrons, to introduce the idea that electrons have wave-like properties, reinforce the concept of the Bohr-Rutherford electron model and to engage students. <p>(NGSS: HS-PS1-1; DCI: Chemical Reactions, Structure and Properties of Matter; SEP: Developing and Using Models and Constructing Explanations & Solutions; CC: Energy & Matter and Stability and Change)</p>	<p>Students will heat a number of metallic/ionic salts in solution in a Bunsen burner and compare the emitted colors that emerge with known colors of different elements. Students will record and diagram their observations and based on their findings, determine the identity of unknown elements from their spectral analyzes.</p>	September - November 2022-23	<p>Students will be assessed through multiple measures throughout the unit:</p> <ul style="list-style-type: none"> General Q&A Laboratory experimentation based on the identification of ionic, metallic and unknown solutions Formative assessment on notes and properties of the Electromagnetic Spectrum Summative assessment containing multiple choice, short responses and matching on ions and role of valence electrons in producing visible colors

<p>Unit: Calculating the Molar Masses of Atoms, Chemicals & Compounds</p> <ul style="list-style-type: none"> Obj: This lesson reinforces the properties of the periodic table, formation of ionic and covalent compounds and the conservation of mass theory through the calculation of the molar masses of substances based on their chemical formula. Based on their chemical formula, students will provide evidence that every chemical has a unique molar mass based on its chemical composition. SWBAT relate the molar mass of compounds to the concept of the 'mole' and 'Avogadro's number' as the unit for measuring atoms (NGSS: HS-PS1-7; DCI: Structure and Property of Matter: SEP: Planning and Carrying Out Investigations: CC: Patterns and Structure and Function) <p>Using the periodic table, students will determine the molar masses of atoms and compounds from periodic table data. SWBAT calculate the molar mass of compounds based on their molar ratios and/or number of moles. SWBAT explain the concept of a mole and molar mass and be able to perform mole-mass conversions through lab activities, notes, whiteboards, and practice</p>	<p>Students will be assessed through multiple measures throughout the unit:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class simulations and practices Calculation of the molar masses of ionic and covalent compounds through worksheet and laboratory experimentation Formative and Summative assessments using multiple choice, short responses and matching type questions on the calculation of molar mass, moles and Avogadro's number of atoms
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<p>Unit: Borax Ornaments - Formation of Crystalline Structures</p> <ul style="list-style-type: none"> Obj: This lesson provides students the ability to demonstrate their understanding of multiple concepts including the periodic table, atoms, bonding, intermolecular forces and stoichiometry as demonstrated from performing a lab to make Borax crystals. (NGSS: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-7. DCI: Chemical Reactions, Structure and Properties of Matter; SEP: Developing and Using Models and Constructing Explanations & Solutions; CC: Energy & Matter and Stability and Change) <p>Students will prepare different concentrations of Borax solutions and test their conductivity to determine the optimal concentration for Borax crystallization. Students will construct different types of ornaments from pipe cleaners or wired frames. Upon completion, students will compare which Borax solution concentration and conductivity produced the optimal crystals.</p>	<p>Students will be assessed through multiple measures throughout the unit:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class simulations and practices Calculation of Borax solution concentration and conductivity via laboratory experimentation Generation of Borax crystalline structures Formative and Summative assessments using multiple choice, short responses and matching type questions on the calculation of the molar mass, conductivity and crystal structures of Borax solutions
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<p>Unit: Chemical reactions & stoichiometry -</p> <ul style="list-style-type: none"> Obj: These investigations provide students with the ability to experiment with reaction concentration and temperature to observe the effects on a chemical reaction. This simulation is coupled with questions that lead students to develop a conceptual understanding about how these factors affect reaction rates. (NGSS: HS-PS1-4, HS-PS1-5; DCI: Chemical Reactions, Structure and Properties of Matter; SEP: Developing and Using Models and Constructing Explanations & Solutions; CC: Energy & Matter and Stability and Change) 	<p>During this lesson, students will extrapolate from chemical reactions that reactions involve the rearrangement of atoms into new substances. This lesson relies on some compound modeling by students to predict the process and type of atom rearrangement during a reaction. Students will provide evidence for the conservation of mass by balancing reaction equations and determining the chemical reaction stoichiometry of reactants and products.</p>	<p>January - March 2023</p>	<p>Students will be assessed through multiple measures:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class simulations and practices Accuracy and precision of calculating the concentrations of select ionic and metallic solutions Online simulations and worksheet practices Laboratory experimentation on the effect of temperature and other factors on concentration Formative and Summative assessments using multiple choice, short responses and matching type questions on the calculation of the molar mass, balancing equations, stoichiometry, conductivity and the effect of temperature and other factors
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<p>Unit: Types of Chemical Reaction - Determination of Single vs. Double Displacement Reactions</p> <ul style="list-style-type: none"> Obj: SWBAT to identify different types of chemical reactions based on characteristics of reactants and products. Students will be required to employ their knowledge of chemical reactions, balancing, stoichiometry, molar mass and moles to prepare and perform the reactions and determine the types of chemical reactions. <p>(NGSS: HS-PS1-5, HS-PS1-7; DCT: Chemical Reactions, Structure and Properties of Matter; SEP: Developing and Using Models and Constructing Explanations & Solutions; CC: Energy & Matter and Stability and Change)</p>	<p>During this lesson, Students will engage in the SEP of Asking Questions and Defining Problems. As students are learning the different types of chemical reactions they will be required to ask questions and make observations which are used to determine patterns that occur in each type of reaction. Students will be expected to observe and learn that patterns exist in each of the 5 types of chemical reactions and be able to recognize each reaction based on these patterns and attributes.</p>	<p>January - February 2023</p>	<p>Students will be assessed through multiple measures:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class Online simulations and in class worksheet practices Laboratory experimentation on the determination of single vs. double displacement reactions Formative and Summative assessments using multiple choice, short responses and matching type questions on the calculation of the molar mass, balancing equations, stoichiometry, conductivity and the determination of single vs. double displacement reactants, products and factors
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<p>Unit: The Energy of Phase Changes</p> <ul style="list-style-type: none"> Obj: Students will be able to explain how the effect of phase changes on molecules and be able to perform calculations using conductivity, latent heat of fusion and vaporization through taking notes, working with partners, watching a video, performing a lab, and answering practice questions. (NGSS: HS-PS3 and HS-PS5; DCI: Relationship between energy and forces; SEP: Developing and Using Models; CC: Cause and effect) <p>St: ts will develop and use models and select compounds to learn about the effect of heat on the state of matter. Students will compare and contrast effect of heat and conductivity of water, ionic and covalent compounds and extrapolate these findings in determining the molecular interactions and chemical properties</p>	<p>March - May 2023</p>	<p>Students will be assessed through multiple measures:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class Online simulations and in class worksheet practices Laboratory experimentation on the different phases (solid, liquid & gas) of water, antifreeze and select solutions Formative and Summative assessments using multiple choice, short responses and matching type questions on the calculation of the molar mass, balancing equations, stoichiometry, conductivity and the determination energy phase diagrams and graphs
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<p>Unit: Determination of the Electromagnetic Radiation Spectrum & Waves - How We See Colors?</p> <ul style="list-style-type: none"> Obj: Students will learn the parts of the electromagnetic spectrum and develop understanding of how it interacts with matter by either being absorbed, reflected or transmitted. (NGSS: HS-PS4-1, HS-PS4-4; DCI: Energy in Chemical Processes and Everyday Life, Electromagnetic Radiation and Wave Properties; SEP: Asking Questions and Defining Problems, Using Mathematical and Computational Thinking and Engaging in Argument from Evidence; CC: Cause and Effect and Stability and Change) <p>Using videos and inquiry-based questions on how the human eye perceives color, students will test their understanding by observing and recording the spectral patterns the element electrode tubes of select atoms.</p> <p>Students will calculate the energies, wavelengths and frequency of visible light and formulate and compare the effect of polarized filters and lenses.</p>	<p>December 2022-February 2023</p>	<p>Students will be assessed through multiple measures:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class Online simulations and in class worksheet practices Calculation of wavelength, frequency and type of electromagnetic wave radiation Diagramming of electromagnetic spectrum Formative and Summative assessments using multiple choice, short responses and matching type questions on the calculation of the molar mass, balancing equations, stoichiometry, conductivity and the determination of electromagnetic radiation types, wavelengths, frequency and visible color spectrum
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<p>Unit: DNA Analysis of Biological Compounds via Electrophoresis</p> <ul style="list-style-type: none"> Obj: SWBAT apply their prior knowledge of the structure of DNA to investigate the process of DNA fingerprinting as it relates to forensic analyzes, biochemistry and Biology and AP curriculums. (NGSS: HS-L-LS3-1; DCI: Structure and Function and Inheritance of Traits; SEP: Asking Questions and Defining Problems, Developing and Using Models and Analyzing and Interpreting Data; CC: Scale, Proportion and Quantity, Cause and Effect and Systems and System Models) <p>St: Students will have the opportunity to build upon their prior knowledge of DNA to a new level as they explore real-world applications using DNA fingerprinting. Students will explore and compare the steps of gel electrophoresis in an online simulation versus real-time application and use their new found knowledge to write a reaction, obtain, evaluate and communicate their findings about DNA and DNA fingerprinting.</p>	<p>Students will be assessed through multiple measures:</p> <ul style="list-style-type: none"> General Q&A Use of google slides and online video to complete in class Online simulations and in class worksheet practices DNA analysis of select compounds (i.e., fruits, vegetable, bacteria & molds) Forensic DNA analysis of unknown insect, fruit or vegetable Formative and Summative assessments using multiple choice, short responses and matching type questions on the properties of DNA, RNA & proteins
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Glassboro Education Foundation

Grant Application

E. Itemized Budget (*All items are available through Amazon Prime*)

Materials/Equipment	Services	Evaluation Techniques
<u>Item(s): 1</u> SH-2 MAGNETIC HOT PLATE STIRRER WITH 1 INCH STIR BAR QUANTITY: 6 COST: \$359.94	BRAND NAME: TAISITESMART EAN: 0796345972897	
<u>Item(s): 2</u> EISCO-ESRPH11978 SPECTRUM TUBE POWER SUPPLY, 110V AC QUANTITY: 1 COST: \$199.99	BRAND NAME: EISCO EAN: 0849230033736 , 0696748388304 , 0078292631585 , 0696736128752 MODEL: ESRPH1197B	
<u>Item(s): 3</u> LAB SCALE 5000G X 0.01G ACCURACY HIGH PRECISION ELECTRONIC ANALYTICAL BALANCE LABORATORY PRECISION SCALE QUANTITY: 6 COST: \$540.00	BRAND NAME: GPJYYDS MODEL#: YYDS-B5000/0.01	

<u>Item(s): 4</u> LAB ANALYTICAL BALANCE 0.1 mg HIGH PRECISION SCALES QUANTITY: 1 COST: \$499.99	EAN: 0600509834541 PART#: FL3-MT204
<u>Item(s): 5</u> WALTER EL-200-16 ELECTROPHORESIS LAB SET QUANTITY: 1 COST: \$693.45	BRAND NAME: WALTER PRODUCTS EAN: 0799361830665 PART#: EL-200-16
<u>Item(s): 6</u> YANTRA 110V AC SPECTRUM TUBE POWER SUPPLY WITH 22 ELEMENT SPECTRUM TUBES QUANTITY: 1 COST: \$455.00	BRAND NAME: YANTRA EAN: 7425218789739 PART#: SPTU22GA
<u>Item(s): 7</u> DIGITAL LAB SPECTROPHOTOMETER VISIBLE SPECTROPHOTOMETER QUANTITY: 1 COST: \$359.99	BRAND NAME: FENCIA PART#: 2021101802
<u>Item(s): 8</u> CR SPOTLESS WATER SYSTEMS-DIC-20 SIMPLEST RV & CAR QUANTITY: 1 COST: \$439.00	BRAND NAME: CR SPOTLESS MODEL: CR SPOTLESS (300 GAL.)

<u>Item(s): 9</u>	CR SPOTLESS RC2-20 REPLACEMENT CARTRIDGES QUANTITY: 2 COST: \$278.00	BRAND NAME: CR SPOTLESS MODEL: CR Spotless RC2-20 Replacement Cartridges For DI with DIC-20
<u>Item(s): 10</u>	GESHATEN $\frac{3}{4}$ " GHT FEMALE X $\frac{3}{4}$ " NPT MALE CONNECTOR, GHT QUANTITY: 1 COST: \$20.99	BRAND: GESHATEN EAN: 0745672901100 MODEL#: GESHATEN-34BSP
<u>Item(s): 11</u>	CRISPAIRE LAB ANALYTICAL BALANCE 0.1MG/120G ELECTRONIC LABORATORY SCALE 0.0001G PRECISE DIGITAL SCALE RS232 INTERFACE LCD DISPLAY CHEMICAL PLANT (120G) QUANTITY: 1 COST: \$330.00	BRAND NAME: CRISPAIRE PART#: FBA-SMJ-20 TOTAL ITEMS: <u>22</u> GRAND TOTAL: <u>\$4,176.29</u>

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All



EN

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Dr., get \$60 off instantly upon approval for the Prime Store Card.

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Price

Lab Scale 5000g x 0.01g
Accuracy High Precision

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101

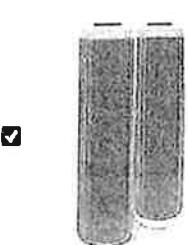
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**Digital Lab Spectrophotometer
Visible Spectrophotometer**

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**Yantra 110 V AC Spectrum
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Qty: 1



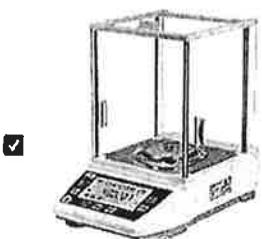
**Walter EL-200-16
Electrophoresis Lab Set,**

\$693.45

In Stock

Shipped from: Vision Scientific Inc.
Gift options not available. Learn more

Qty: 1



**Lab Analytical Balances 0.1mg
High Precision Lab Scales**

\$499.99

Only 6 left in stock - order soon.

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Size: 200gx0.0001 (with 200g Calibration
Weights)

Qty: 1



EISCO-ESRPH1197B Spectrum
Tube Power Supply, 110 V AC,

\$199.99

Only 16 left In stock (more on the way).

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