

Science 1

Course Outcome Summary

Course Information

Organization	Madison Area Technical College
Developers	Bill CaplanCrLfDixie Burns
Development Date	1/6/2003
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Course Number	31-806-363
Instructional Level	General Education
Potential Hours of Instruction	72
Total Credits	2

Description

Covers basic principles of physics which have frequent and common practical applications for students pursuing a vocation in trade and industry. Relates applications to student vocational fields. Includes measurement, mechanics, machines, properties of matter, fluid principles, heat and electricity. Features lecture, discussion and laboratory.

Types of Instruction

Instruction Type	Contact Hours	Credits
Classroom Presentation	36	2
On-Campus Lab	36	

Textbooks

Jane Breun. *Vocational Science*. MATC. **Source:** MATC bookstore.

Learner Supplies

Scientific Calculator. **Manufacturer:** any. **Quantity:** 1.

Exit Learning Outcomes

Core Abilities

- A. Mathematics
- B. Science and Technology

General Education Outcomes

- A.

Competencies

Unit 1. Measurement and Technical Math

- A. Investigate measurement

You will demonstrate your competence:

- A.1. By completing measurement lab in class
- A.2. By completing metric system problem set
- A.3. By completing unit conversion problem set
- A.4. By taking an in-class exam

Your performance will be successful when:

- A.1. you identify the accuracy of measurement instruments
- A.2. Measurements are expressed with significant figures which match the accuracy of the measurement instrument
- A.3. Measurements of the same quantity with different instruments are the same within the accuracy of the instruments
- A.4. Converted measurements are correct
- A.5. you perform metric conversions by moving the decimal point and/or adding zeros
- A.6. you select correct conversion factor(s)
- A.7. you show conversion ratios when converting units
- A.8. you show units at all stages in solution, including final answer
- A.9. Converted measurements have same number of significant digits as original measurement

B. Solve basic algebra problems

You will demonstrate your competence:

- B.1. By completing problem sets
- B.2. By taking an in-class exam

Your performance will be successful when:

- B.1. you represent quantities with variables
- B.2. you substitute given numbers for variables into formulas
- B.3. you rearrange formulas to solve for an indicated variable

C. Create graphs of data

You will demonstrate your competence:

- C.1. By completing graphing problem set
- C.2. By creating graphs of laboratory data

Your performance will be successful when:

- C.1. you label graph axes with quantities and units
- C.2. you determine a scale for the graph that uses even increments (e.g. 1, 2, 5, or 10) and uses most of the graph paper
- C.3. you title your graph
- C.4. you correctly place easily readable data points
- C.5. you sketch a line of best fit with a ruler
- C.6. you determine the slope of the line of best fit

D. Use scientific problem solving method

You will demonstrate your competence:

- D.1. By completing problem-solving problem set
- D.2. By completing problem sets throughout the semester
- D.3. By completing labs throughout the semester
- D.4. By taking in-class exams

Your performance will be successful when:

- D.1. you identify known and unknown quantities with variables for a problem

- D.2. you select an appropriate formula to solve the problem
- D.3. you identify unknown quantities and rearrange the formula to solve for the unknown
- D.4. you substitute known quantities for variables in formula
- D.5. you show units when substituting
- D.6. you identify and perform any necessary unit conversions
- D.7. you write a final answer including units

E. Investigate vectors and scalars

You will demonstrate your competence:

- E.1. By completing the force table lab in class
- E.2. By taking an in-class exam

Your performance will be successful when:

- E.1. you distinguish between a vector and a scalar
- E.2. you use the force table to determine equilibrants
- E.3. you draw a free body diagram of the vectors acting on an object
- E.4. you select and apply a scale to convert physical quantities into graphical vectors
- E.5. you draw vectors using a ruler and a protractor
- E.6. you add vectors by connecting them head-to-tail
- E.7. you break vectors into components using sines and cosines
- E.8. you add the components of vectors
- E.9. you combine the components of a vector into a magnitude and direction using Pythagoras's theorem and tangents

Unit 2. Classical Mechanics

A. Investigate linear motion

You will demonstrate your competence:

- A.1. By completing linear motion problem set
- A.2. By completing gravity and linear motion lab in class
- A.3. By taking an in-class exam

Your performance will be successful when:

- A.1. you solve speed problems using $v=s/t$ and the scientific problem solving method
- A.2. you distinguish speed and velocity
- A.3. you solve acceleration problems using $a=\Delta v/t$ and the scientific problem solving method
- A.4. you express acceleration in terms of the acceleration due to gravity

B. Apply Newton's laws

You will demonstrate your competence:

- B.1. By completing Newton's laws problem set
- B.2. By taking an in-class exam

Your performance will be successful when:

- B.1. you solve thought problems using Newton's first law
- B.2. you solve problems using Newton's second law and the scientific problem solving method
- B.3. you solve thought problems using Newton's third law
- B.4. you distinguish force, mass and weight
- B.5. you relate mass and weight using Newton's second law and the acceleration due

to gravity

C. Investigate friction

You will demonstrate your competence:

C.1. By completing friction problem set

C.2. By completing friction lab in class

C.3. By taking an in-class exam

Your performance will be successful when:

C.1. you identify the physical properties on which friction depends

C.2. you solve friction problems using the coefficient of friction and the scientific problem solving method

D. Investigate centripetal motion

You will demonstrate your competence:

D.1. By completing centripetal motion problem set

D.2. By completing the centripetal motion lab in class

D.3. By taking an in-class exam

Your performance will be successful when:

D.1. you relate rate of rotation (rpm) to linear speed

D.2. you identify the centripetal forces causing circular motion

D.3. you solve problems using the centripetal force relationship and the scientific problem solving method

E. Investigate work, energy and power

You will demonstrate your competence:

E.1. By completing work, energy and power problem sets

E.2. By completing the power lab in class

E.3. By taking an in-class exam

Your performance will be successful when:

E.1. you solve problems using $W = Fd$ and the scientific problem solving method

E.2. you solve problems using conservation of energy and the scientific problem solving method

E.3. you identify the effect of changing speed and mass on kinetic energy

E.4. you solve power problems using the scientific problem solving method

F. Apply concepts of torque and equilibrium

You will demonstrate your competence:

F.1. By completing the torque and equilibrium problem set

F.2. By completing the plane equilibrium lab in class

F.3. By taking an in-class exam

Your performance will be successful when:

F.1. you solve torque problems using the scientific problem solving method

F.2. you identify the torque arm when a force is applied at an angle

F.3. you solve translational equilibrium problems using the scientific problem solving method

F.4. you solve rotational equilibrium problems using the scientific problem solving method

F.5. you use translational and rotational equilibrium in conjunction to solve problems (optional at professor's discretion)

G. Investigate simple machines

You will demonstrate your competence:

- G.1. By completing the simple machines problem set
- G.2. By completing the simple machines lab in class
- G.3. By taking an in-class exam

Your performance will be successful when:

- G.1. you solve problems using AMA, IMA and efficiency and the scientific problem solving method
- G.2. you identify the IMA formula for the six types of simple machines
- G.3. you apply simple machines concepts to explain a tool or machine used in your technical area
- G.4. you set up examples of different types of simple machines

Unit 3. Properties of Matter

A. Investigate states of matter

You will demonstrate your competence:

- A.1. By discussing states of matter in class
- A.2. By taking an in-class exam

Your performance will be successful when:

- A.1. you identify the three states of matter
- A.2. you identify the properties of the three states of matter
- A.3. you analyze the molecular theory explaining each of the three states of matter

B. Investigate deformation of matter

You will demonstrate your competence:

- B.1. By completing spring problem set
- B.2. By completing stress and strain problem set
- B.3. By completing stress and strain lab
- B.4. By taking an in-class exam

Your performance will be successful when:

- B.1. you solve spring problems using Hooke's law
- B.2. you solve problems using stress and strain concepts and Young's Modulus
- B.3. you identify the ultimate strength, elastic limit and Young's modulus from experimental data

C. Investigate density and specific gravity

You will demonstrate your competence:

- C.1. By completing the density problem set
- C.2. By completing the specific gravity problem set
- C.3. By completing density and specific gravity labs
- C.4. By taking an in-class exam

Your performance will be successful when:

- C.1. you solve problems using the density relationship
- C.2. you solve problems using specific gravity

D. Investigate pressure

You will demonstrate your competence:

- D.1. By completing the pressure problem set
- D.2. By completing the pressure lab

D.3. By taking an in-class exam

Your performance will be successful when:

D.1. you solve problems using the pressure relationships

D.2. you solve problems using Pascal's principle

E. Investigate buoyancy and Archimedes' principle

You will demonstrate your competence:

E.1. By completing buoyancy problem set

E.2. By completing specific gravity lab

E.3. By taking an in-class exam

Your performance will be successful when:

E.1. you solve problems using buoyancy principles

F. Investigate viscosity

You will demonstrate your competence:

F.1. By completing viscosity lab

F.2. By taking an in-class exam

Your performance will be successful when:

F.1. you define viscosity

F.2. you explain the relationship between viscosity and temperature

Unit 4. Thermal Physics

A. Use Fahrenheit, Celsius, Kelvin and Rankine temperature scales

You will demonstrate your competence:

A.1. By completing the temperature problem set

A.2. By taking an in-class exam

Your performance will be successful when:

A.1. you express temperatures in Fahrenheit, Celsius, Kelvin and Rankine

A.2. you identify the freezing and boiling point of water in Fahrenheit, Celsius, Kelvin and Rankine

A.3. you distinguish between 0 degrees Fahrenheit or Celsius and absolute zero

B. Convert temperatures between Fahrenheit, Celsius, Kelvin and Rankine

You will demonstrate your competence:

B.1. By completing the temperature problem set

B.2. By taking an in-class exam

Your performance will be successful when:

B.1. you select the correct conversion relation

B.2. you add and/or multiply the quantities in the relation in the correct order

C. Apply gas laws

You will demonstrate your competence:

C.1. By completing the gas laws problem set

C.2. By taking an in-class exam

Your performance will be successful when:

C.1. you solve problems using the temperature/pressure relationship and the scientific problem solving method

C.2. you solve problems using the pressure/volume relationship and the scientific problem solving method

C.3. you solve problems using the temperature/volume relationship and the scientific

problem solving method

C.4. you solve problems using the general gas law and the scientific problem solving method

D. Investigate thermal expansion

You will demonstrate your competence:

D.1. By completing the thermal expansion problem set

D.2. By completing the thermal expansion lab in class

D.3. By taking an in-class exam

Your performance will be successful when:

D.1. you identify the dependencies for thermal expansion

D.2. you solve thermal expansion problems using the scientific problem solving method

D.3. you apply thermal expansion concepts to physical situations

E. Investigate specific and latent heat

You will demonstrate your competence:

E.1. By completing the heat and latent heat problem sets

E.2. By completing calorimetry and bomb calorimeter labs

E.3. By taking an in-class exam

Your performance will be successful when:

E.1. you solve specific heat problems using the scientific problem solving method

E.2. you solve latent heat problems using the scientific problem solving method

E.3. you identify heat losers and gainers and solve calorimetry problems using thermal equilibrium and using the scientific problem solving method

F. Investigate heat transfer

You will demonstrate your competence:

F.1. By completing the R-value problem set

F.2. By taking an in-class exam

Your performance will be successful when:

F.1. you distinguish between convection, conduction and radiation

F.2. you give examples of convection, conduction and radiation

F.3. you identify heat transfer examples as convection, conduction or radiation

F.4. you solve heat conduction problems using the scientific problem solving method

Unit 5. Electricity and Magnetism

A. Investigate the atom

You will demonstrate your competence:

A.1. By discussing the atom in class

A.2. By completing an in-class exam

Your performance will be successful when:

A.1. you identify the components of the atom

A.2. you examine the basic structure of the atom

B. Investigate electrostatics

You will demonstrate your competence:

B.1. By taking an in-class exam

Your performance will be successful when:

B.1. you investigate the relationship between charge and force

- B.2. you investigate the arrangement of charges and associated forces in various electrostatic situations
- B.3. you construct and identify electric field diagrams for various charge distributions
- B.4. you summarize voltage or electric potential

C. Investigate simple circuits

You will demonstrate your competence:

- C.1. By completing problem sets
- C.2. By completing circuits lab
- C.3. By taking an in-class exam

Your performance will be successful when:

- C.1. you identify the parts of a simple circuit, including conductors, current sources, resistors and other loads, and switches
- C.2. you examine the functioning of a chemical battery
- C.3. you construct and read simple circuit diagrams
- C.4. you apply simple circuit diagrams to create a circuit
- C.5. you use a multimeter to measure voltage and current
- C.6. you apply Ohm's law to complete circuits problems
- C.7. you solve series circuits
- C.8. you solve parallel circuits
- C.9. you solve combination circuits

D. Investigate electric power

You will demonstrate your competence:

- D.1. By completing electric power problem sets
- D.2. By completing electric power lab
- D.3. By taking in-class exams

Your performance will be successful when:

- D.1. you solve problems using the electric power relationship
- D.2. you calculate the cost of electricity usage
- D.3. you investigate the functioning of fuses and circuit breakers

E. Investigate magnetism

You will demonstrate your competence:

- E.1. By discussing magnetism in class
- E.2. By taking an in-class exam

Your performance will be successful when:

- E.1. you examine the relationship between magnetic fields and electric current
- E.2. you investigate the functioning of electric generators and motors
- E.3. you investigate the functioning of inductors and transformers
- E.4. you calculate steps up or down in voltage in a transformer

Unit 6. Light and Sound

A. Investigate light

You will demonstrate your competence:

- A.1. By completing light lab

Your performance will be successful when:

- A.1. you use a grease-spot photometer to determine the relationship between distance and intensity

A.2. you measure light intensity in real-world situations and compare to recommended light levels

B. Investigate sound

You will demonstrate your competence:

B.1. Completing sound lab

Your performance will be successful when:

B.1. you investigate the relationship between sound intensity and distance

B.2. you measure sound intensity using a sound meter

B.3. you identify dangerous levels of sound, and safe lengths of exposure