UNIT OVERVIEW

BIOMEDICAL ENGINEERING

Unit Issue: How science, technology, and engineering can be used to design solutions to improve the health and wellness of others.

Anchoring Phenomenon: Engineered solutions can improve people's health and functioning.

Listed below is a summary of the activities in this unit. The total teaching time as listed is 13–18 periods of approximately 45–50 minutes each (approximately 3–4 weeks if you teach the activities as recommended every day). If you cannot finish in this time frame, consider skipping activities 5 and/or 8.

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
1. **Investigation: Save Fred!** Students are introduced to the process of engineering by solving a simple physical problem. The activity elicits and builds on students' ideas about how to develop a successful solution.	engineering, engineer, scientist SENSEMAKING	Gather gummy candies.		1–2
2. **Investigation: Me, An Engineer?** By simulating an injury to the dominant arm, students use their ingenuity and some simple supplies to invent solutions to problems they encounter accomplishing everyday tasks. Through the experience, students consider the practical needs of people with disabilities and the impact of biomedical engineering.	biomedical engineer	Gather clothing, shoes, hair clips, dolls, boxes, glue, scissors, tape; set up stations; prepare Student Sheets.		1–2
3. **Reading: Bionic Bodies** Students explore the application of biomedical engineering through the case studies of three individuals. These cases show that individual needs, desires, and values help drive the development of new technologies.	constraint, criteria, biomedical engineering LITERACY, MATHEMATICS	Prepare Student Sheet.	EXP A5 (Summative Assessment)	1–2
4. **Design: Artificial Bone Model** Students are challenged to design, build, and test models of an artificial bone to meet criteria. They analyze the quantitative data from different prototypes and combine ideas to optimize their designs.	criteria, constraint, model, prototype, variable, optimize LITERACY SENSEMAKING MATHEMATICS	Gather balances, digital scale, pennies; cut strips of paper; set up testing stations; prepare Student Sheets.	ENG Proc.	2–3
5. **Design: Artificial Heart Valve** Students apply the engineering design process to developing a model for an artificial heart valve. Students create initial prototypes, test, evaluate, and redesign their solutions in an iterative engineering design process.	engineering design process, aortic valve, model, prototype, variable, optimize LITERACY SENSEMAKING	Gather plastic bins, sponges, mops, scissors, tape, colored pencils; construct sample valves; prepare Student Sheets.	ENG Proc. (Summative Assessment) E&T A5	2–3

BIOMEDICAL ENGINEERING (continued)

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
6. **Reading: The Work of an Engineer** Students explore the discipline of engineering in more detail. They read about the interplay between science, engineering, and technology in the development of new products.	technology, engineering design process, engineer, scientist LITERACY SENSEMAKING	Prepare Student Sheet.	E&T A4	1–2
7. **Investigation: Energy Bar** Students evaluate the ingredients of various energy bars to determine how each design best meets criteria. Then they design an energy bar to meet particular nutritional need of a specific medical condition.	carbohydrate, fat, protein, criteria, constraints, evaluating designs MATHEMATICS	Prepare Student Sheets.	ARG Proc., A4 (Summative Assessment)	1–2
8. **Laboratory: Investigating Biomechanics** Students explore the biomechanics of muscles and tendons in a chicken wing as background knowledge to later design a gripping device. This information on the structure and function of a wing is used to develop a model of movement.	biomimicry, function, structure, tendon	Buy chicken wings; gather bleach, garbage bags, forceps, dissection scissors and trays.	MOD A2	1–2
9. **Design: Get a Grip** Students use the approach of biomimicry to design, test, evaluate, and redesign a mechanical gripping device to meet criteria. They use a reiterative process to optimize the device in one of two ways.	design, structure, function model, robotics, engineering design process, optimize LITERACY SENSEMAKING	Gather pennies, scissors; set up testing stations; prepare Student Sheet.	ENG Proc. (Summative Assessment)	2–3