

Safety First

INTEGRATED
CURRICULUM UNIT
ON WORKPLACE
INJURIES



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National Healthcare Foundation Standards that apply to this unit include:

- Academic Foundations
- Communications
- Employability
- Ethics
- Teamwork
- Information Technology Applications

Safety First

UNIT OVERVIEW

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Unit Summary

This unit focuses on the causes of workplace injuries and the consequences for workers, employers, and society as a whole. Students will investigate the biological and physical basis for injury on the job, regulations governing the work environment in the United States, and how public and government perception of who is responsible for work-related injuries has changed through history.

Subunit 1 focuses on the individual employee's perspective on workplace injuries. Students are introduced to common workplace injuries, and connect them to their previous knowledge of body systems. They discuss the effects of stress on the body and the physics of proper lifting techniques in their science or physical education classes. Students then expand their knowledge of strategies to prevent injuries under different conditions.

The obligations of the employer as related to workplace injuries are explored in Subunit 2. Students learn that federal and state regulations protect workers on the job, and translate the complicated language of government regulations into persuasive brochures on labor and health standards that are easy to understand. Math lessons investigate industrial applications—how cumulative noise level is calculated in decibels, and how to highlight trends in data by displaying information graphically. The subunit also includes an exploration of the variety of health professionals employees visit to be diagnosed, treated, and rehabilitated after injury.

In Subunit 3 students study the evolution of workplace injuries and views about responsibility for those injuries over the centuries. They learn how the Industrial Revolution changed the work environment and influenced types of workplace injuries. Then they survey the progression of regulations and judicial cases related to responsibility for workplace

injuries in the United States. The balance between social and personal responsibility for work accidents and the role of government regulation for adults and teens is discussed.

Culminating Event

In most companies, a company's Human Resources department is responsible for informing employees about the risks of injury in the work environment and the resources available when an employee is injured. For the culminating event, students select a company and take on the roles of various health and safety professionals that a Human Resources team would ask to research and report on common workplace injuries. Student work includes a PowerPoint presentation, a summary brochure, an in-depth safety manual, and an organized oral presentation. This activity is described in detail in Lesson 3.4 of the unit.

Key Questions/Issues

- What are the common workplace injuries in the United States? How are they best prevented and treated? (Health Science, Biology, Physics)
- What rights and resources do workers have when they are injured on the job? What are the laws and regulations governing teen workers? How can one tell if a workplace is following OSHA safety regulations? (English Language Arts)
- How is noise a worker safety issue? How does a company calculate the cumulative amount of noise created by multiple machines, in order to see if a room is safe for workers? (Algebra II)
- What is the most effective way to display different types of trend data? (Algebra I)
- What are the healthcare professions that address individuals' workplace injuries? How do you become one of those professionals? (Health Science)
- How did the Industrial Revolution change the workplace landscape? What were the implications for workplace injuries? (World History)
- How have views about the responsibility for workplace injuries changed in the United States? (U.S. History or U.S. Government)

- What is the best way to inform an audience about the prevention, treatment, and legal requirements related to workplace injuries? (English Language Arts)

Learning Scenario to Kick Off the Unit

Jerry gets a new job as a delivery person at the local food manufacturing plant. Due to an old football injury from high school, he has a weakened back, and lifting more than 50 pounds would risk a new injury. He tells his employer his medical history, and the employer agrees to reduce his lifting responsibilities to loads that weigh 50 pounds or less, despite government guidelines that allow workers to lift heavier objects. If there is a load that is heavier, Jerry can have another person lift it or get assistance. One day, a box is accidentally mislabeled due to mechanical error. It weighs 65 pounds, still within government-allowed weight limits. Jerry lifts the box and suffers a slipped disk.

Who should pay for Jerry’s medical care and lost productivity? Should it be Jerry, or his employer?

Biomedical/Healthcare and Education Partner Roles

- School librarian/media specialist can assist the Math, Health Science, and/or English Language Arts instructors with teaching research skills,

particularly in the use of print and other media resources.

- A Computer Technology or Graphic Arts instructor can assist with the layout and production of brochures and flyers.
- Invited speakers can discuss the treatment of workplace injuries and related laws; possibilities include physical therapists, occupational therapists, human resources specialists, safety specialists, and OSHA inspectors.
- Additional individuals can be invited to participate as speakers or to help evaluate the culminating event. These include:
 - Exercise Physiologist
 - Kinesiologist
 - Recreation Therapist
 - Speech, Language Pathologist
 - Respiratory Therapist
 - Radiologist
 - Psychologist

SUBUNITS AND MAJOR TOPICS (ACROSS ACADEMIC AND TECHNICAL SUBJECT AREAS)

Subunit 1 *Personal Injury*

BIOLOGY · HEALTH SCIENCE · PHYSICS

- Introduction to workplace injuries
- Effects of stress on the body
- Science of lifting and proper body mechanics
- Strategies for preventing work-related injuries
- Fight-or-flight stress response

Subunit 2 *Workplace Safety*

HEALTH SCIENCE · ALGEBRA I · ALGEBRA II · ENGLISH LANGUAGE ARTS

- Applications of logarithms and exponents
- Reading and understanding government and legal documents
- Creating clear graphical representations of data
- Creating persuasive flyers and brochures
- Persuasive techniques in propaganda and advertising
- Treatment and rehabilitation strategies for common workplace injuries
- Treatment- and rehabilitation-related occupations

Subunit 3 *Taking Responsibility*

WORLD HISTORY · U.S. HISTORY OR U.S. GOVERNMENT · ENGLISH LANGUAGE ARTS

- Public health issues during the Industrial Revolution
- History of workplace injury regulations and court cases from the early 19th century until present day
- Use of multimedia strategies for research on workplace injuries common to a specific company or industry sector
- Composition and delivery of oral presentations for specific audiences

Personal Injury

SUBUNIT 1 OVERVIEW

Essential Question for This Unit

How can work-related injuries be reduced, and who should be responsible for implementing reduction strategies?

Subunit Goals

Subunit 1 focuses on the individual employee's perspective on workplace injuries. Students begin by reviewing major body systems and learning the common workplace injuries related to those systems. They are also introduced to federal and state regulations aimed at protecting workers from workplace injuries. In their science or physical education classes, students discuss the effects of stress on the body and the physics of proper lifting techniques. Finally, they learn about simple strategies for injury prevention and proper body mechanics.

Subunit Key Questions

- What are the most common workplace injuries in the United States? (Health Science)
- How does acute and long-term stress affect my body? (Biology)
- How do you manually lift objects properly? What is the scientific basis for this method? (Physics or Physical Education)
- What is the healthiest layout for a computer workstation? What is the best way to carry a heavy backpack? (Health Science)

Lesson Summaries

| Lesson | Subject | Description |
|--------|----------------|---|
| 1.1 | Health Science | Introduction to Workplace Injuries Students review major body systems and learn the medical terminology needed to describe common workplace injuries ranging from musculoskeletal strains to environmental exposure to chemicals. |
| 1.2 | Biology | Stressed Out Students learn the basic neurobiology of stress and how it is related to the evolutionary fight-or-flight survival response. Students examine the normal function of the HPA feedback loop, which regulates the stress response, its effect on the body, and how chronic stress can lead to both physical and mental problems. |
| 1.3 | Physics | Lift Right Students analyze the physics of manual lifting by finding examples of levers in the human body and calculating the torque applied when lifting objects. Students apply this knowledge to learning proper body mechanics for prevention of back injury while lifting. |
| 1.4 | Health Science | Prevention of Workplace Injuries Students learn about general strategies to prevent injury caused by force trauma, contamination, fire, and improper body mechanics. They then apply their knowledge of body mechanics to specific daily tasks such as carrying a backpack and working at the computer. |

Introduction to Workplace Injuries

LESSON 1.1

HEALTH SCIENCE

Time

200 minutes

Materials

Equipment

- Anatomy charts
- Human skeleton model
- Overhead projector
- Colored pencils
- Classroom Internet access (optional)

Resources

- Human Body Systems Challenge Puzzle (<http://sciencespot.net/Media/hlthhumbdy chall.pdf>) or Human Body Systems Review game (<http://sciencespot.net/Media/hlthhumbdypuzz.pdf>)
- Vocabulary and Medical Terminology handout
- Work-Related Incidents: Injuries and Illnesses handout
- Skeleton diagram/transparency (<http://www.beabonebuilder.com/worksheets/page3a1.html>)
- Anatomical and Directional Terms handout
- Common Workplace Injuries and Illnesses Presentation Preparation worksheet
- Workplace Injuries Research worksheet (optional)

Prior Student Learning

Students should have a general understanding of the muscular and skeletal systems.

Essential Question for This Unit

How can work-related injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Categorize work-related injuries.
- Identify at least two common workplace injuries within each of the following categories: work-related musculoskeletal disorders, traumatic physical injuries, environmental exposures, occupational diseases, and psychological disorders.
- Define terminology common to the musculoskeletal system.
- Identify at least three bloodborne pathogens that can be transmitted in a hospital setting.
- Identify signs and symptoms of trauma to the cardiovascular, musculoskeletal, nervous, integumentary, and sensory systems.
- Identify different types of fractures.

Lesson Activities

Unit Introduction

Introduce the unit by explaining that workplace injuries can affect people in important ways. Students who have part-time jobs and any family member who works can be affected.

In this unit, students will learn about the impact workplace injuries have on the national economy and on individuals' personal lives. Tell students that they will be studying the prevalence, causes, and effects of workplace injuries; learning what their rights and obligations are under the law as workers and employed minors; and gaining an understanding of the history behind current views on worker injury.

Explain to students that they will need to report on at least three common workplace injuries at the end of the unit. In doing so, they will need to conduct research on and present the following information: a detailed medical description of the injury, how the injury is diagnosed, how it is treated, the kind of rehabilitation involved in overcoming the injury, and how best to prevent future injuries.

Tell students that in the Health Science class they will learn about many workplace injuries to help them understand the ones that are most com-

Unit Organization

This is an ideal time to introduce the Health Science course requirements that relate to the culminating event, as described in Lesson 3.4. An optional assignment that builds into the culminating event is included in this lesson.

Introduction to Workplace Injuries

LESSON 1.1

mon in the industry they will select and work on for the unit's culminating event.

Lesson Springboard

Today's lesson will help students understand medical terminology and the anatomy and physiology of common workplace injuries.

To activate prior knowledge, have students participate in a review game or activity about body systems. A selection of word searches about different body systems are available at <http://sciencespot.net/Pages/classpuzzle.html>, which also provides links to other web resources for puzzles. Because the majority of workplace injuries are musculoskeletal, it is especially helpful to review the skeletal system. (A worksheet can be found at <http://www.beabonebuilder.com/worksheets/page3a1.html>; use it to create an overhead.) Together as a class, label and color the different bones on the overhead. Discuss the ones that are often injured in workplace accidents. Get students accustomed to using terms such as *radius* versus *arm*.

Classroom Management

This lecture is intended to take no more than 25–30 minutes, to allow enough time for a class activity during the same period.

Depending on the number of discussions, the amount of class participation, and so on, this lesson can be broken up into two or more class periods. It is preferable to group students with mixed abilities together.

Lesson Development

Direct Instruction

Healthcare professionals describe injuries with great detail and using proper medical terminology. Point out that the activities and handouts included in this lesson will prepare them to act as a “healthcare professional,” which will serve them well as adults and in the unit's culminating activity.

Briefly go over of the Work-Related Incidents handout. Students will be working more with this information later in the lesson. In this class, injuries are classified in two ways.

Injuries Stemming from Work-Related Incidents

- **Work-Related Musculoskeletal Disorders (WRMDs).** These disorders typically result from work activities that are frequent and repetitive, or from activities with awkward postures. The group does *not* include disorders caused by slips, falls, motor vehicle accidents, and the like.
- **Traumatic Physical Injuries.** These are wounds or other conditions caused by external forces including physical stress and strain. They are usually caused by a specific injury or incident or a series of events or incidents within a single workday or shift.
- **Environmental Exposures.** These injuries are caused by excessive time in heat, cold, high-humidity, or other physically stressful conditions.
- **Occupational Diseases.** These are disorders and diseases that result from systemic infections or exposure to toxins, poison fumes, noise, etc. in the work environment over a longer period of time. They must be caused by at least a two-day exposure.
- **Stress and Psychosocial Illnesses.** These are disorders that are caused by excessive and/or long-term exposure to mentally stressful environments.

Introduction to Workplace Injuries

LESSON 1.1

Injuries Classified by Symptoms and Affected Body Systems

- **Musculoskeletal Injuries.** The most common musculoskeletal injuries involve a group of painful disorders of *soft tissues*: muscles, tendons, ligaments, nerves, joints, cartilage, and spinal disks.
- **Blood and Cardiovascular Trauma.** Includes shock, hemorrhage, and so on.
- **Respiratory System Irritants, Trauma, and Illnesses.** Includes asthma, lung cancer, pneumothorax, and suffocation.
- **Digestive System Disorders.** Includes trauma to internal organs, irritable bowel syndrome resulting from stress, *E. coli* or *salmonella* poisoning, and so on.
- **Immune System Disorders from Bloodborne Pathogens.** Includes HIV, hepatitis.
- **Integumentary System Traumas.** Includes abrasions, hypothermia, burns, avulsions, lacerations, and radiation.
- **Nervous System Injuries.** Includes concussions, contusions, skull fractures, epidural hematomas, spinal cord injuries, and so on.

Support Strategy

If students have difficulty with the directional terms, have them match pairs of terms with opposite meanings.

Have students stand and act out directional terms.

Have volunteers point out different directional terms on the model skeleton.

Next give students the Anatomical and Directional Terms and Vocabulary and Medical Terminology handouts. Explain that this part of the lesson will focus on general musculoskeletal injuries, the most common of the workplace injuries.

Review the Anatomical and Directional Terms handout with students. This handout provides vocabulary about body planes, symmetry, major body cavities, and directional terms. Tell students that in describing individual injuries, it is important for them to be specific about the location of the injury, for example, a “radial distal fracture.”

Review the Vocabulary and Medical Terminology handout with students and encourage them to use these terms when discussing injuries in any of their classes. The Medical Terminology terms should include the following:

| | |
|-----------|--------------|
| -algia | pain |
| arthro/o | joint |
| brachi/o | arm |
| cost/o | rib |
| crani/o | skull |
| epi | above |
| -itis | inflammation |
| lumb/o | lower back |
| kinesi(o) | movement |
| my/o | muscle |
| oste/o | bone |
| sub | under/below |
| tend/o | tendon |
| thorac/o | chest |

Introduction to Workplace Injuries

LESSON 1.1

Role-Play in Pairs

After receiving the brief overview of important terminology, students will work in pairs to develop their understanding. Assign each pair of students two or three injuries/illnesses from the Work-Related Incidents handout and have them research the symptoms and treatments of those injuries using reference books and the Internet. They can fill in the Common Workplace Injuries and Illnesses Presentation Preparation worksheet to prepare for their presentations.

When ready, students can act out common situations leading to the injuries they were assigned. One partner will act as a patient and role-play the situation that led to the injury. The patient then goes to the doctor and describes the symptoms of the injury using layman's terms. The other partner plays the doctor, and explains the injury using proper medical terminology. The class takes notes on the each presentation.

Check for understanding by acting as a patient while the entire class acts as the diagnosing doctor. Pretend to have certain symptoms or act out common workplace situations, and ask the class to identify the possible injury that has occurred or will occur.

If the unit culminates in a presentation of workplace injuries (as suggested in Lesson 3.4,) the Workplace Injuries Research worksheet is a good intermediate assignment to move students toward preparing for the culminating event. The worksheet asks students to give details on three common injuries in their industry. They must describe the workplace hazards, the injury itself, and signs and symptoms of the injury. References should be included. You may decide to assign it now or later in the unit, as appropriate. Be sure to emphasize that in order to get a high grade on the worksheet, students must be thorough in their research, use proper medical terminology, be specific in their descriptions, and provide statistical evidence (students will research statistical evidence in their math classes).

Lesson Closure

End the lesson by telling students they have learned about the many kinds of injuries that can afflict individuals in today's workplace. But workers are not without resources aimed at protecting them from workplace injuries. Briefly introduce the idea that the federal and state governments have occupational safety and health agencies that regulate practices at work sites, that workers have the right to medical treatment for workplace injuries, and that employers can face penalties for violating the rules of these agencies. Students will learn much more about these rules and protections later in the unit.

Possible Prior Misconceptions

Students may not be aware of how common musculoskeletal injuries are in the workplace or the number of different injuries that employees are susceptible to.

Introduction to Workplace Injuries

LESSON 1.1

Student Assessment Artifacts

Notes from lecture

Completed worksheets from body systems review games

Short presentations describing two to three common injuries

Completed Workplace Injuries Research worksheet (optional)

Variations and Extensions

As an extension, students should have at least one day in the computer lab or library for research to complete the Workplace Injuries Research worksheet.

Students can examine X-rays or other visual scans of musculoskeletal injuries and have them explained by a healthcare professional.

National and State Career Technical Education Standards

NATIONAL

NCHSTE National Healthcare Skill Standards

- 1.24 Analyze body system changes in light of diseases, disorders, and wellness
- 2.26 Use medical terminology within a scope of practice in order to interpret, transcribe and communicate information, data and observations
- 4.22 Listen attentively to verbal instruction, requests, and other information to verify accuracy
- 4.23 Provide written communication that is accurate and grammatically correct, using nomenclature appropriate to the environment
- 4.24 Interpret technical materials used for healthcare practices and procedures
- 6.22 Respect interdisciplinary roles of team members

CALIFORNIA

Health Science and Medical Technology Standards

1.2 Science

- (5.c) Students know how bones and muscles work together to provide a structural framework for movement.
- (10.a) Students know the role of the skin in providing non-specific defenses against infection.
- (10.b) Students know the role of antibodies in the body's response to infection.

2.2 Writing

- (1.5) Synthesize information from multiple sources and identify complexities and discrepancies in the information and the different perspectives found in each medium (e.g., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents).
- (1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).
- 2.5 Know and understand medical terminology to interpret, transcribe, and communicate information and observations necessary for workers in the healthcare industry.

Name _____ Date _____ Period _____

Work-Related Incidents: Injuries and Illnesses



I. Work-Related Musculoskeletal Disorders (WRMD/MSD or WMD/MSI)

Definition: A group of painful disorders of “soft tissue” (muscles, tendons, ligaments, nerves, joints, cartilage, spinal disks). These disorders typically result from work activities that are frequent and repetitive, or from activities with awkward postures (Does *not* include disorders caused by slips, falls, motor vehicle accidents, etc.)

Other names: repetitive strain injuries, cumulative trauma disorders, muscular skeletal injuries, overuse syndrome, soft tissue disorders.

Examples:

- Carpal tunnel syndrome
- Epicondylitis
 - Lateral epicondylitis (tennis elbow, pitcher’s elbow—outside)
 - Medial epicondylitis (golfer’s elbow—inside)
- Rotator cuff syndrome
- Bursitis
- Sciatic pain
- De Quervain’s disease
- Trigger finger
- Tarsal tunnel syndrome
- Tendonitis
- Vibration syndrome
- Raynaud’s phenomenon
- Housemaid’s knee
- Herniated spinal disk
- Low-back pain (LBP)
- Sprains
- Strains
- Dislocations
- Tenosynovitis
- Guyon’s Canal Syndrome
- Thoracic outlet syndrome
- Tension neck syndrome
- Plantar fasciitis

Name _____ Date _____ Period _____

II. Traumatic Physical Injury

Definition: A wound or other condition caused by external forces, including physical stress and strain. It is usually caused by a specific injury or incident or a series of events or incidents within a single workday or shift.

Examples:

- Spinal cord injury (SCI)
- Fractures (including comminuted, closed, open, greenstick, compression, impacted)
- Amputations
- Concussions
- Contusions
- Burns (heat, chemical, electrical, e.g., welding slash burns)
- Knee (may also be in overuse category—torn meniscus, cruciate ligament tears (ACL), etc.)
- Iliotibial band syndrome
- Shin splints
- Hemorrhages
- Concussions
- Contusions
- Subdural hematomas
- Shock (cardiogenic, septic, hypovolemic, anaphylactic)
- Eye injuries (corneal abrasion, retinal detachment)
- Skin injuries (abrasions, blunt trauma, avulsion, crush trauma, puncture injury, lacerations)

III. Environmental Exposures

Definition: Injuries that result from excessive exposure to natural environmental extremes.

Examples:

- Frostbite
- Hypothermia
- Trench foot
- Heatstroke
- Radiation
- Electrical injury
- Hearing loss (sensorineural deafness)

IV. Occupational Diseases

Definition: Disorders and diseases that result from systemic infections, exposure to toxins, poison fumes, noise, etc. in the work environment over a longer period of time. (Must be caused by at least a 2-day exposure.)

Examples:

- Hearing problems
- Vocal problems (laryngitis, etc.)
- Skin cancer

Name _____ Date _____ Period _____

- Lung cancer
- Asthma
- Pneumoconiosis (e.g., black lung)
- Chronic obstructive pulmonary disease (COPD)
- Chemical irritation of the eye or respiratory system (common gases that cause irritation include: formaldehyde, ammonia, chlorine, solvents, paints)
- Allergies (e.g., latex)
- Biological Infections (mold, HIV, hepatitis, *staph*, tuberculosis, anthrax, *E.coli*, *salmonella*)

V. Stress and Psychosocial Illnesses

Definition: Disorders that are caused by excessive and/or long-term exposure to mentally stressful environments.

Examples:

- Sleep disorders
- Anxiety disorders
- Depressive disorders

Name _____ Date _____ Period _____

Anatomical and Directional Terms

Directional Terms

| | |
|----------------------|--|
| Superior | On top of a certain structure or location |
| Inferior | Beneath a certain structure or location |
| Ventral | Toward the belly of an animal |
| Dorsal | Toward the back of an animal |
| Medial | Toward the body midline or in the center |
| Lateral | On the side |
| Intermediate | Between two organs, objects, or points |
| Ipsilateral | On the same side of the body |
| Contralateral | On opposite sides of the body |
| Proximal | Toward an origin or closest to the body midline |
| Distal | Farther away from an origin or farther from the body midline |
| Superficial | Toward the surface |
| Deep | Away from the surface |
| Oral | Close to the mouth |
| Aboral | Opposite of the mouth |
| Anterior | Toward the front |
| Posterior | Toward the rear |

Planes and Sections

| | |
|---|---|
| Midsagittal | A plane dividing a bilaterally symmetrical organism into two mirror image halves. |
| Parasagittal | A plane dividing a bilaterally symmetrical organism into two unequal halves. |
| Frontal or Coronal | A plane dividing a bilaterally symmetrical organism into a front and a back half. |
| Transverse (Cross-Sectional) | A plane passing through a structure or organism that is at a 90-degree angle to the long axis of the structure. |
| Oblique | A plane passing through a structure or organism that is at an angle other than 90 degrees. |

Name _____ Date _____ Period _____

Major Vertebrate Body Cavities

| | |
|-----------------------|---|
| Cranial | Cavity containing the brain |
| Spinal | Cavity containing the spinal cord |
| Thoracic | Cavity containing the heart, lungs, and most of the esophagus |
| Abdominal | Cavity containing most of the digestive system and parts of the urinary system |
| Pelvic | Cavity containing the reproductive organs, end of the digestive tract, and parts of the urogenital system (bladder) |
| Abdominopelvic | Cavity containing the abdominal and urogenital organs |

Name _____ Date _____ Period _____

Vocabulary and Medical Terminology: Workplace Injuries—Musculoskeletal

Medical Terminology

- -algia pain
- arthr/o joint
- brachi/o arm
- cost/o rib
- crani/o skull
- epi above
- -itis inflammation
- lumb/o lower back
- kinesi(o) movement
- my/o muscle
- oste/o bone
- sub under, below
- tend/o tendon
- thorac/o chest

Vocabulary

- Abrasion Open wound, road burn, etc. in which outer skin layer has been stripped off
- Avulsion Painful soft-tissue injury in which a flap of tissue is torn loose or pulled off completely
- Bursitis Inflammation of a bursa (small fluid-filled sac between bones and muscles/tendons)
- Concussion Injury to the brain or spinal cord accompanied by loss of neural function resulting from a blow to the head
- Contraction Shortening or tightening of a muscle
- Contusion Soft-tissue injury caused by seepage of blood into tissue (a bruise)
- Dislocation Separation of a joint and malposition of an extremity
- Distension Expansion or swelling
- Fracture A crack or break in a bone
- Hematoma A blood-filled swollen area; bleeding under tissues
- Hemorrhage The severe, abnormal internal or external discharge of blood
- Hemothorax Blood within the pleural cavity
- Impingement Compression of soft tissue between the ends of two or more bones due to tissue inflammation or bone displacement
- Radiating pain Pain that spreads from a central point, such as the point of injury
- Rehabilitation The process of recovering from an injury through treatment and education designed to assist injured patients in regaining maximum function, a sense of well-being, and the highest level of independence possible
- Shock A condition that occurs when an inadequate amount of blood flows through the body, causing extremely low blood pressure, a lack of urine, and other disorders—a potentially fatal condition
- Tendon Fibrous connective tissue around a joint that connects muscle to bone
- Tendonitis Inflammation of a tendon

Name _____ Date _____ Period _____

Common Workplace Injuries and Illnesses Presentation Preparation

Name: _____

Partner's Name: _____

Assigned Injuries/Illnesses: 1) _____

2) _____

3) _____

Injury/Illness 1:

Common workplace situation that would lead to this injury or illness:

Signs and symptoms of the injury or illness:

Medical terminology used to describe this injury or illness:

Injury/Illness 2:

Common workplace situation that would lead to this injury or illness:

Signs and symptoms of the injury or illness:

Medical terminology used to describe this injury or illness:

Name _____ Date _____ Period _____

Injury/Illness 3:

Common workplace situation that would lead to this injury or illness:

Signs and symptoms of the injury or illness:

Medical terminology used to describe this injury or illness:

Name _____ Date _____ Period _____

Workplace Injuries Research



Company/Industry _____

DIRECTIONS: After researching at least **three** common injuries that occur in the company/industry you choose, complete the following information **for each injury**.

Note: Workplace hazards are incidents and items that contribute to the occurrence of the injury—for example, falling from a ladder, chemical exposure, overexposure to heat, slipping on wet floors, lifting heavy objects, repetitive computer work, etc.

Injury Descriptions

I. Injury 1 _____

1. Workplace Hazard(s) _____

2. Injury Description (include anatomy and physiology—body parts affected)

3. Signs and Symptoms of Injury

4. Statistical Evidence (How common is this injury? **Include source.**)

5. Evidence in Presentation (Check all those that apply.)

- _____ PowerPoint Slides
- _____ Visual (Type: _____)
- _____ Verbal explanation from medical expert, injured party, etc.
- _____ Other (E.g., skit: _____)

Name _____ Date _____ Period _____

II. Injury 2 _____

1. Workplace Hazard(s) _____

2. Injury Description (include anatomy and physiology—body parts affected)

3. Signs and Symptoms of Injury

4. Statistical Evidence (How common is this injury? **Include source.**)

5. Evidence in Presentation (Check all those that apply.)
_____ PowerPoint Slides
_____ Visual (Type: _____)
_____ Verbal explanation from medical expert, injured party, etc.
_____ Other (E.g., skit: _____)

Name _____ Date _____ Period _____

III. Injury 3 _____

1. Workplace Hazard(s) _____

2. Injury Description (include anatomy and physiology—body parts affected)

3. Signs and Symptoms of Injury

4. Statistical Evidence (How common is this injury? **Include source.**)

5. Evidence in Presentation (Check all those that apply.)

- _____ PowerPoint Slides
- _____ Visual (Type: _____)
- _____ Verbal explanation from medical expert, injured party, etc.
- _____ Other (E.g., skit: _____)

Subunit 1—Personal Injury
Stressed Out
LESSON 1.2

BIOLOGY

Time

100 minutes

Materials

Equipment

- Air horn
- 1 live goldfish
- Petri dish
- 2 glass slides
- Absorbent cotton batting
- Light microscope with projector or flex cam
- Epinephrine solution
- Water

Resources

OSHA speech on workplace stress: “Work, Stress, & Health ‘95” (http://www.osha.gov/pls/oshaweb/owadispl.show_document?p_table=SPEECHES&p_id=198)

Prior Student Learning

Students should be familiar with the nervous and endocrine systems.

Students should be familiar with the general function of neurotransmitters and hormones in the body.

Essential Question for This Unit

How can work-related injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Identify the basic elements of stress.
- Describe the response of the brain and body to danger and other stresses.
- Analyze the basic neurobiology of the stress (fight-or-flight) response.
- Describe the physical and psychological consequences of chronic stress.

Lesson Activities

Lesson Springboard

Stand behind your desk or in some location where you can hide an air horn or other loud noisemaker. Lower the lights in the room, and have students close their eyes. Tell them to relax and calmly describe taking a walk through the woods. Begin with a description of a pleasant walk, but eventually describe a slightly ominous path. In the middle of your guided imagery, blow the air horn without warning.

Classroom Management

Important: Warn the teachers in surrounding classrooms that you will be using an air horn near the beginning of the class period.

Quickly get students to list their immediate physical reactions to the unexpected noise (increased pulse rate, jumping out of seat, hand tremble, and so on). Ask student why they think their bodies has reacted this way.

Lesson Development

Direct Instruction

Tell students that the physical and psychological response they have just endured is the body’s natural response to startling events. *Stress* is essentially the body’s response to any demand that disturbs normal functioning. Any event that is perceived as difficult, dangerous, or threatening can be stressful.

Walter Cannon identified this response as “fight-or-flight”—the body’s response to threat or danger. In the face of danger, a body can produce dozens of physiological responses to better enable it to deal with the stressor. Breathing rate increases so that more oxygen can get to the cells; heart rate increases to get the blood quickly to the large muscle groups that might be needed to fight or flee; the endocrine system releases adrenaline into the bloodstream, giving a boost of energy and strength; muscles tense up and prepare for strong physical activity; and pupils dilate to let in more light, improving vision.

Stressed Out

LESSON 1.2

While Dr. Cannon believed this to be an advantageous defense mechanism (which it is), Hans Selye recognized that if the reaction were to go on too long or be triggered too often, it could lead to damage and illness. Selye observed that the body's reaction to stress of any kind was always the same, regardless of whether there was any "true" danger. He believed that eventually the body's supply of stress hormones would become depleted, leading to illness (although it now appears that prolonged exposure to stress hormones is what actually causes damage).

Stress effects are regulated by the endocrine system, specifically the hypothalamic-pituitary-adrenal (HPA) axis. The hypothalamus secretes hormones that control the pituitary gland, which in turn secretes hormones that control other glands, including the adrenal glands. This set of three organs works together in a feedback loop.

When the HPA axis works normally, a perception of a stressful event causes the axis to initiate the fight-or-flight response to prepare the body to deal with the threat. However, there is evidence indicating that chronic stress can lead to malfunctioning in the HPA axis feedback loop.

Under normal circumstances the HPA axis works as follows:

- In the presence of a stressor, the fight-or-flight response is activated, which triggers the release of adrenaline from the adrenal glands. Adrenaline (also known as the neurotransmitter/hormone epinephrine) increases heart rate, dilates blood vessels running to the muscles, constricts blood vessels to the skin and gut, increases metabolism, and raises blood pressure.
- The initial stress reaction triggers the hypothalamus to release corticotropin-releasing hormone (CRH) into the bloodstream.
- The presence of CRH stimulates the pituitary gland to release adrenocorticotrophic hormone (ACTH, also called corticotropin) into the bloodstream.
- ACTH in the bloodstream signals the adrenal glands to release another, longer-lasting stress hormone: cortisol.
- The hypothalamus monitors and adjusts the release of CRH based on the level of cortisol in the bloodstream. As cortisol levels rise, the hypothalamus reduces or ceases the release of CRH.

When a body experiences chronic stress, the hypothalamus loses its ability to regulate properly, allowing elevated levels of cortisol to remain in the bloodstream. Among other things, elevated cortisol negatively affects the brain's ability to regulate mood, which increases feelings of stress.

Demonstration

Completely soak the cotton batting in water. Place a layer of wet cotton batting at the bottom of the petri dish. Wrap the goldfish in more wet cotton and place it in the petri dish with the caudal (tail) fin hanging

Stressed Out

LESSON 1.2

over the edge. Add extra water to the petri dish to keep the cotton and the goldfish immersed.

Sandwich the caudal fin between two glass slides and position the fin on the microscope stage so you can observe the fin near its distal edge. Use the cotton and the glass slides to keep the goldfish from flopping out of position. Using the microscope projector or flex cam, students should be able to observe the circulation of blood through the fin.

Find a place where an arteriole and a capillary are in the same field at low power. Observe for a moment and have students note the speed of the blood circulation. Ask students what they think will happen if you add epinephrine. Students may respond that blood flow will increase, since adrenaline is a cardiovascular stimulant. You may or may not wish to remind students that they are observing the edge of the fin, which is at the periphery of the circulatory system.

Add 2 drops of epinephrine solution to the fin and observe the reaction in the rate of blood flow. Students will observe that the blood flow decreases after the application of epinephrine. If students are surprised, remind them that epinephrine restricts blood flow in the peripheral circulatory system. Have the class discuss what the evolutionary advantage to limiting peripheral blood flow in reaction to adrenaline might be.

Class Discussion

Ask students if they are stressed. They are likely to say yes. Ask them to describe specifically how they know they are stressed. Is it a physical feeling? Is it an emotion? What exactly are they referring to as stress, and how do they cope with it? What makes them feel better?

The workplace can also be a highly stressful place. In 1995, a speaker for the Occupational Safety & Health Administration (OSHA) noted the following at a conference of the American Psychological Association:

A 1992 survey by Northwestern National Life Insurance Co. found that four out of 10 employees (40%) feel their jobs are “very” or “extremely stressful.” With statistics like that, it should come as little surprise that the number of stress-related disability claims by American workers doubled during the period from 1982 to 1990, according to the Employee Assistance Professionals Association in Arlington, Va. The American Institute of Stress (based in Yonkers, N.Y.) reports as many as 75 to 90% of visits to physicians are related to stress—with an estimated cost to industry of \$200 billion to \$300 billion a year.

The workplace has been identified as the greatest single source of stress. The causes of such stress can range from the anxieties produced by corporate downsizing to factors that result in physical disorders such as carpal tunnel syndrome. Stress also can result from simply a feeling on the part of the individual worker that he or she is not appreciated on the job or is being overwhelmed by family obligations.

Stressed Out

LESSON 1.2

In 1994, the Women’s Bureau of the Department of Labor conducted a landmark survey of how working women in America feel about their jobs. More than a quarter of a million women told of their concerns and experiences.

Stress ranks as working women’s No. 1 problem, the survey found. This problem was identified by almost 60% of all respondents, cutting across all income and occupational groups. Stress is particularly acute for women in their 40s who hold professional and managerial jobs (74%) and for single mothers (67%).

We in OSHA are concerned that stress on the job can breed violence, even homicide. And when violence does occur or is even a potential threat, stress increases. Northwestern National Life Insurance Co. found that in companies where violence has been threatened, the employee burnout rate goes up to 49%, compared with 34% for all companies. (Joseph Dear, Assistant Secretary of Labor for Occupational Safety and Health, September 14, 1995)

Have students discuss how workplace stress might be similar to the stress they experience as students. How should responsibility for dealing with stressors be divided between employers and employees?

Lesson Closure

Not all stress is bad, and having no stress is not necessarily good either. The relationship between stress and performance (in sports, on exams, at work) can be represented graphically as an inverted U-shaped curve. Performance is often best at moderate levels of stress. Too much or too little stress corresponds with a weaker performance. For **homework**, have students write a short essay explaining this relationship using the information from today’s lesson.

Possible Prior Misconceptions

Some students may believe there is no advantage to stress, and that stress should always be avoided.

Student Assessment Artifacts

Stress-performance essay

Variations and Extensions

Describe and practice basic relaxation and stress management exercises with the class, like meditation and deep breathing exercises.

Have students keep a stress log and then make an action plan for reducing stress in their lives.

National and State Academic Standards**NATIONAL****NRC National Science Education Standards***Life Science*

Behavior of Organisms

- Multicellular animals have nervous systems that generate behavior. Nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. In sense organs, specialized cells detect light, sound, and specific chemicals and enable animals to monitor what is going on in the world around them.
- Organisms have behavioral responses to internal changes and to external stimuli. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes; these responses either can be innate or learned. The broad patterns of behavior exhibited by animals have evolved to ensure reproductive success. Animals often live in unpredictable environments, and so their behavior must be flexible enough to deal with uncertainty and change. Plants also respond to stimuli.
- Like other aspects of an organism's biology, behaviors have evolved through natural selection. Behaviors often have an adaptive logic when viewed in terms of evolutionary principles.

CALIFORNIA**Science Content Standards***Biology/Life Science*

9. As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. As a basis for understanding this concept:
 - b. *Students know* how the nervous system mediates communication between different parts of the body and the body's interactions with the environment.
 - c. *Students know* how feedback loops in the nervous and endocrine systems regulate conditions in the body.
 - i. **Students know* how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms.

PHYSICS**Time**

50 minutes

Materials

Lift Wrong worksheet

Prior Student Learning

Students should be familiar with balanced forces.

Students should be familiar with how to calculate mechanical advantage in levers.

Essential Question for This Unit

How can work-related injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Define and calculate torque.
- Describe how the back acts as a lever when lifting.
- Calculate the force applied on the lower back when lifting an object with your back.
- Demonstrate proper lifting technique for heavy objects.

Lesson Activities**Lesson Springboard**

Have all the students stand up, holding a textbook in one hand. Have half the class hold their arm straight out at shoulder height, and have the other half hold the book close to their body. Students will quickly observe that holding the book away from the body is much more tiring. Ask students why that would be the case—after all, the book’s weight is not dependent on how close or far it is from the body. Ask students to come up with other examples where distance affects how difficult a task seems (e.g., pushing open a door near the hinges vs. at the doorknob, using wrenches with different length handles).

Lesson Development**Direct Instruction**

With rotation, something beyond force is obviously at work. Introduce *torque*, the rotational counterpart to force. Torque can be calculated using the following formula:

$$\text{Torque} = \text{lever arm} \times \text{force}$$

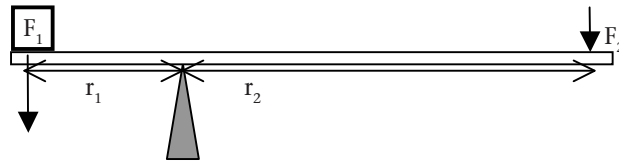
$$\tau = r \times F$$

The force used in the torque formula is the force perpendicular to the radius of rotation. You can explain to students that torque is a vector, but the directional aspect can be a little confusing. At the very least, students should be aware that torque has a sign indicating the direction of rotation, much as a sign indicates direction in linear motion. By convention, counterclockwise motion is positive and clockwise motion is negative. At equilibrium (no rotational motion), the *net torque* is zero.

Lift Right

LESSON 1.3

Any student who has balanced on a seesaw should be familiar with the effect of torque. As shown in the diagram, mechanical advantage “amplifies” the force of F_2 so that only a small amount of force is necessary to balance a much larger weight.

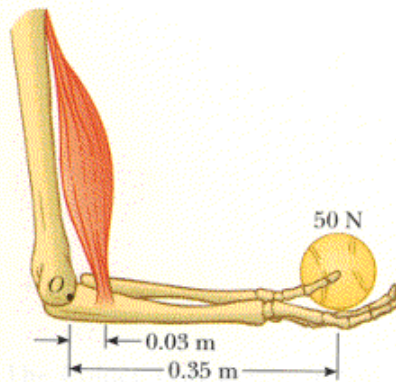


$$\tau_{\text{counterclockwise}} = \tau_{\text{clockwise}}$$

$$r_1 \times F_1 = r_2 \times F_2$$

Class Discussion

In the body, the skeletal and muscular systems act together to form a series of levers. Draw a bicep on the board. Have students identify the type of lever and point of rotation and then calculate the torque exerted by the bicep to keep the baseball level.

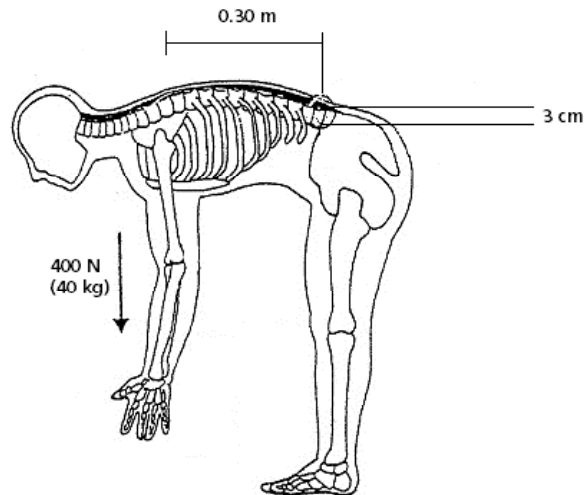


Ask the students if they notice anything strange about this lever. Students may recognize that this lever is providing a mechanical *disadvantage*. Why might this system be advantageous?

The back acts as a lever to lift objects, as well. When you bend over to pick up an object (or just bend over), the pull of gravity on your upper body applies a torque around your hips that pulls the body downward (counterclockwise in the diagram below). Remind students that torque can be calculated as lever arm \times force, and at equilibrium, $\tau_{\text{clockwise}} = \tau_{\text{counterclockwise}}$. Pass out the Lift Wrong worksheet and have students to solve the following problems:

1. What would be the torque applied by just your upper body? (120 Nm)
2. What force is being applied to maintain this position? (4000 N)
3. Imagine you are picking up 20 kg bag of flour. What additional torque is applied? (60 Nm)
4. What would the total force applied to the back be now? (6000 N)

Support Strategy
Remind students to convert centimeters (cm) to meters (m).



This is an incredibly large amount of force being exerted on the lower back. Not surprisingly, any job that requires a lot of bending and lifting of an object is apt to produce a back injury.

Given what they have learned about torque, what can students deduce regarding reducing the strain on the lower back? Appropriate lifting technique includes:

- Keeping the load as close to the body as possible.
- Keeping the back upright (looking forward helps with this).
- Keeping feet apart and turned outward (for stability).
- Bending your knees and using your leg muscles to provide the force.

Lesson Closure

Were students surprised by how force is needed to move their body around? Now that they have learned the wrong way to lift, and why it can cause injury, conclude the lesson by having a few students demonstrate proper lifting technique. You can find many examples of proper lifting techniques on the Internet (e.g., http://www.mayoclinic.com/health/back-pain/LB00004_D).

Possible Prior Misconceptions

After being introduced to rotational motion, some common misconceptions students might have regarding angular momentum include believing that any force acting on an object will produce torque, that objects moving in a straight line cannot have angular momentum, that torque is the same as force and has the same direction, that angular momentum is not a vector, and that the direction of angular momentum is the direction of linear momentum.

Student Assessment Artifacts

Completed Lift Wrong worksheet

Variations and Extensions

Invite the physical education teacher or one of the school coaches to speak about other muscle strains that can occur as a result of improper form.

Expand lesson to include center of mass and angular torque calculations.

Have students examine the forces involved in other difficult physical maneuvers. For example, a detailed example involving the gymnastics feat known as the iron cross is available at <http://files.asme.org/asmeorg/Events/Contests/1170.pdf>.

National and State Academic Standards

NATIONAL NRC National Science Education Standards

Motion and Force

Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship $F = ma$, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.

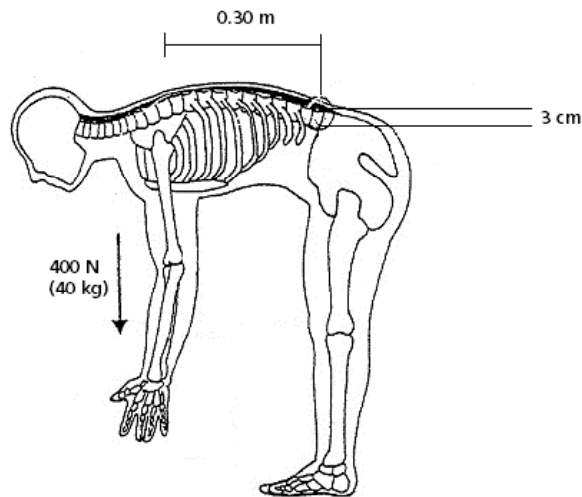
CALIFORNIA Science Content Standards

Physics

1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:
 - d. Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).

Name _____ Date _____ Period _____

Lift Wrong



Solve the following problems. Show all work, and remember to check your units.

1. How much torque is applied by your upper body?
2. To maintain equilibrium, how much force must be applied by your lower back muscles?
3. Imagine you are picking up a 20 kg bag of flour. What additional torque is applied?
4. What would the total force applied to the back be now?

Subunit 1—Personal Injury

Prevention of Workplace Injuries

LESSON 1.4

HEALTH SCIENCE

Time

100 minutes

Materials

Equipment

Bathroom scale

Resources

- OSHA suggestions for healthy computer workstation (<http://www.osha.gov/SLTC/etools/computerworkstations/index.html>)
- Suggestions for preventing workplace injury (<http://www.aiha.org/Content/AccessInfo/consumer/AnErgonomicsApproachtoAvoidingWorkplaceInjury.htm>)
- Carpal Tunnel Syndrome Fact Sheet (http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm?css=print)
- Backpack Strategies for Parents and Students handout (http://www.promoteot.org/Al_BackpackStrategies.html)
- Tips for Good Body Mechanics (<http://medicalcenter.osu.edu/pdfs/PatientEd/Materials/PDFDocs/exer-reh/physical/bod-tips.pdf>)

Prior Student Learning

Students should already be familiar with common workplace injuries from Lesson 1.1 and have general knowledge of the musculoskeletal system.

Essential Question for This Unit

How can work-related injuries be reduced, and who is responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Understand and observe different ways that illnesses and injuries can be prevented in a healthcare setting.
- Examine personal and professional responsibilities regarding workplace injuries.
- Observe and perform proper body mechanics.

Lesson Activities

Lesson Springboard

Introduce the lesson by reminding students that prevention education remains the key ingredient in reducing workplace injuries. Prevention education saves employers money and, of course, protects the health of employees. There are several simple habits workers can learn that will prevent many common injuries.

The instructor or a guest speaker begins the lesson by asking students what is wrong with a workplace scenario. He or she then begins to role-play a worker at their workstation. The instructor performs many “wrong” day-to-day activities. For example, leans back in their chair with their feet propped up, cradles a telephone between ear and shoulder, lifts a heavy box by bending instead of squatting, etc. After a few minutes of role-play, the instructor asks students to come up and “right” all the “wrongs.” After a while, more students begin to come up and point out and correct improper lifting, safety hazards, etc.

Lesson Development

Direct Instruction

After the warm-up, students will begin to take notes on workplace safety. A lecture should include the following:

- Information on ergonomics and body mechanics—principles, guidelines
- Standards used in preventing accidents in healthcare settings: Occupational Exposure to Hazardous Chemicals and Material Safety data sheets; OSHA Bloodborne Pathogens Standards (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051)

Unit Organization

This lesson provides important information for the unit’s culminating event, detailed in Lesson 3.4. Students will be required to think about prevention methods for the common injuries in their company or industry.

Prevention of Workplace Injuries

LESSON 1.4

- Basics on personal safety in a health care setting: Keeping materials clean, required uniforms, reporting of unsafe conditions, hand washing
- Fire safety

It may be helpful to supplement student notes with a handout on suggestions for preventing common workplace injuries (<http://www.aiha.org/Content/AccessInfo/consumer/AnErgonomicsApproachtoAvoidingWorkplaceInjury.htm>), and proper body mechanics (<http://medicalcenter.osu.edu/pdfs/PatientEd/Materials/PDFDocs/exer-reh/physical/bod-tips.pdf>).

Journal Responses

To increase critical thinking skills, ask students to write journal responses to the following situations. Each asks the question “Who is responsible?” You can make up as many scenarios as time permits. After they have answered, discuss personal responsibility and “no-fault” clauses. Further discussion of assigning responsibility regarding workplace injuries will be covered in Subunit 3’s History lessons.

Possible scenarios:

- A nurse strains her back lifting a patient.
- A third-year medical resident tests positive for HIV after being splashed by blood in surgery.
- A medical assistant gets assaulted in the parking lot by one of his or her family members.
- A radiological technician is diagnosed with leukemia after working in radiology for 20 years.

Personal Body Mechanics

Next, to help students better relate to body mechanics in their own lives, discuss student safety. Use backpack safety as a classic example. Have a scale in the classroom; ask for student volunteers who would like to weigh their backpacks. Discuss the recommendation that backpack weight should be no more than 15% of the student’s body weight. Also discuss proper fitting and wearing of a backpack to protect their future back health. An informational handout can be found at http://www.promoteot.org/AI_BackpackStrategies.html.

To complete the lesson, hand out a fact sheet on carpal tunnel syndrome (http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm?css=print). Also discuss the proper way to set up a computer workstation (<http://www.osha.gov/SLTC/etools/computerworkstations/index.html>). If it is not already set up properly, transform a computer station in the classroom or computer lab into a healthy workstation.

Lesson Closure

Have students design a healthy workstation for themselves at home and create a sketch of it. Students can also create a specific action plan

Prevention of Workplace Injuries

LESSON 1.4

for keeping their backpack at an appropriate weight and carrying it the proper way while still having all the materials they need for each class.

Student Assessment Artifacts

Lecture notes

Participation in class discussion on Ergonomics and Personal Responsibility

Journal writing

Healthy home workstation sketch

Specific action plan for back health

Variations and Extensions

Lecture notes can be alternated with journal writing to keep student interest. All handouts can be assigned for reading the day before the lesson.

Invite an occupational therapist to demonstrate the proper techniques of working at a computer workstation. If possible, a guest speaker is helpful in bringing fresh material about workplace safety and etiquette.

National and State Career Technical Education Standards

NATIONAL

NCHSTE National Healthcare Skill Standards

- 7.22 Apply principles of body mechanics and ergonomics
- 7.31 Modify the environment to create safe working conditions
- 7.32 Demonstrate methods of fire prevention in the health-care setting
- 7.33 Prevent accidents by using proper safety techniques
- 7.34 Practice good housekeeping by maintaining a safe work environment
- 10.12 Demonstrate safety procedures to protect clients, co-workers, and self

CALIFORNIA

Health Science and Medical Technology Standards

- 2.5 Know and understand medical terminology to interpret, transcribe, and communicate information and observations necessary for workers in the healthcare industry.
- 6.1 Know the policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
- 6.2 Understand critical elements for health and safety practices related to storing, cleaning, and maintaining tools, equipment, and supplies.
- 6.3 Understand the importance and use of standard precautions and infection control, as appropriate.
- 6.4 Understand the principles of body mechanics and ergonomics in providing patient care.

Workplace Safety

SUBUNIT 2 OVERVIEW

Essential Question for This Unit

How can work-related injuries be reduced, and who should be responsible for implementing reduction strategies?

Subunit Goals

The obligations of the employer as related to workplace injuries are explored in Subunit 2. Lessons 2.2 and 2.4 have students translate the complicated language of government regulations into persuasive brochures on labor and health standards that are easy to understand. Math lessons investigate how to highlight trends in data by displaying it graphically and how cumulative noise level is calculated when multiple machines are in the same room. The subunit includes an exploration of the healthcare professionals who work with injured workers to provide diagnoses, treatment, and rehabilitation.

Subunit Key Questions

- What are the laws and regulations governing teen workers? (English Language Arts)
- Is my workplace following OSHA safety regulations? (English Language Arts)
- How does a company calculate the cumulative amount of noise created by multiple machines, in order to see if the room is safe for workers? (Algebra II)
- What is the most effective way to display different types of trend data? (Algebra I)
- Who are the healthcare professionals that work with injured employees when they experience a workplace accident or illness? (Health Science)

Lesson Summaries

| Lesson | Subject | Description |
|--------|-----------------------|---|
| 2.1 | Algebra I | Injury Trends Students research current injury rates of different industry sectors and create graphical representations of the data. |
| 2.2 | English Language Arts | Understanding the Law Students read child labor standards and create informational brochures in more accessible language. They then investigate the OSHA health standards for major industry sectors and evaluate the safety of their own workplace or school site. |
| 2.3 | Algebra II | Sound Safety Students strengthen their understanding of logarithms and exponents by analyzing changes in noise-level expressed in decibels. Acting as a safety team, the class calculates the impact that adding and subtracting loud machinery has on the overall noise level of a manufacturing room. |
| 2.4 | English Language Arts | Persuasion, Propaganda, and the Public Image Students analyze a particular workplace injury scenario and consider which party they feel is responsible. They then learn about persuasive writing techniques used in propaganda and advertising and apply their new knowledge to create a flyer on workplace safety that would be convincing to both employees and their employer. |
| 2.5 | Health Science | Treatment, Rehabilitation, and Related Occupations Students explore the responsibilities and job descriptions of the healthcare professionals who must collaborate to diagnose, treat, and rehabilitate an injured worker. They then research a specific work-related injury or illness and create a treatment and rehabilitation plan for a fictitious worker. |

Subunit 2—Workplace Safety
Injury Trends
LESSON 2.1

ALGEBRA I

Time

100 minutes

Materials

Equipment

- Overhead with data sets
- Blank pie chart handout
- Graph paper
- Markers and rulers
- Computer lab

Resources

- OSHA Inspection Data (<http://www.osha.gov/oshstats>)
- Bureau of Labor Statistics Occupational Injuries and Illnesses data (<http://data.bls.gov/GQT/servlet/InitialPage>)
- Work Related Injuries Data handout
- School Survey—Common Injuries worksheet

Prior Student Learning

Students should understand what independent and dependent variables are and how to use them in a graph.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Identify the appropriate type of graph or chart to use to represent a given set of data.
- Determine which variable is independent in a data set with two variables.
- Create graphs and charts in Microsoft Excel.
- Label graphs and charts appropriately in Microsoft Excel.

Lesson Activities

Lesson Springboard

Start a short discussion on how graphs and charts are used. Discuss the importance of using a visual aid to make data easier to understand, which in turn can make presentations more persuasive and appealing.

Ask students what makes a graph easy to read and have students record those characteristics in their notes. Ask students to volunteer their ideas and then list them on the board. Discuss the importance of creating descriptive labels.

Show students different sets of data and ask them to decide how they would represent them graphically. Be sure to discuss the importance of identifying the independent variable in their graph. Ask for volunteers to share their graph ideas and explain why they would use them. Then ask the class to discuss the pros and cons of each student's decision. It is important to point out the value of a good legend and color coding, as well as clear labeling.

Lesson Development—Day 1

Give each group the following data set, a set of markers, two straight edges, a blank pie chart sheet, and a blank coordinate plane.

Unit Organization

This is an ideal time to introduce the math requirements for the culminating event, described in Lesson 3.4. This lesson can produce research that builds into the final unit activity.

Injury Trends

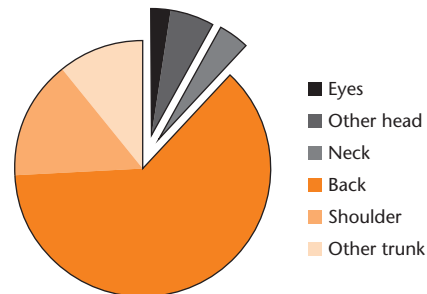
LESSON 2.1

| Industry | Part of Body Affected by the Injury or Illness | | | | | | |
|---------------------------------------|--|-------|------|-------|--------|--------|----------|
| | Total Cases | Head | | | Trunk | | |
| | | Total | Eyes | Neck | Total | Back | Shoulder |
| Ambulatory healthcare services | 25,390 | 1,000 | 270 | 570 | 8,970 | 6,610 | 1,220 |
| Offices of physicians | 5,420 | 380 | 120 | 200 | 1,380 | 940 | 240 |
| Offices of dentists | 1,010 | – | – | – | – | – | – |
| Offices of other health practitioners | 900 | – | – | – | 140 | 120 | – |
| Outpatient care centers | 4,380 | 190 | – | 30 | 1,230 | 850 | 180 |
| Medical and diagnostic laboratories | 840 | 60 | 20 | 20 | 240 | 220 | 20 |
| Home healthcare services | 9,660 | 290 | 50 | 240 | 4,480 | 3,390 | 500 |
| Other | 3,180 | 70 | 50 | 60 | 1,390 | 1,000 | 280 |
| Hospitals | 62,930 | 2,650 | 880 | 1,320 | 28,790 | 20,380 | 4,950 |
| Nursing and residential care | 66,620 | 3,110 | 810 | 1,050 | 31,040 | 22,680 | 4,100 |
| Social assistance | 20,960 | 1,310 | 370 | 510 | 6,660 | 4,390 | 1,230 |

One of the data sets should be a one-variable set, best represented by a pie chart. (To take the Total Cases column into consideration, it would be most accurate to include a “non-head, neck, or truck” section of the pie chart.)

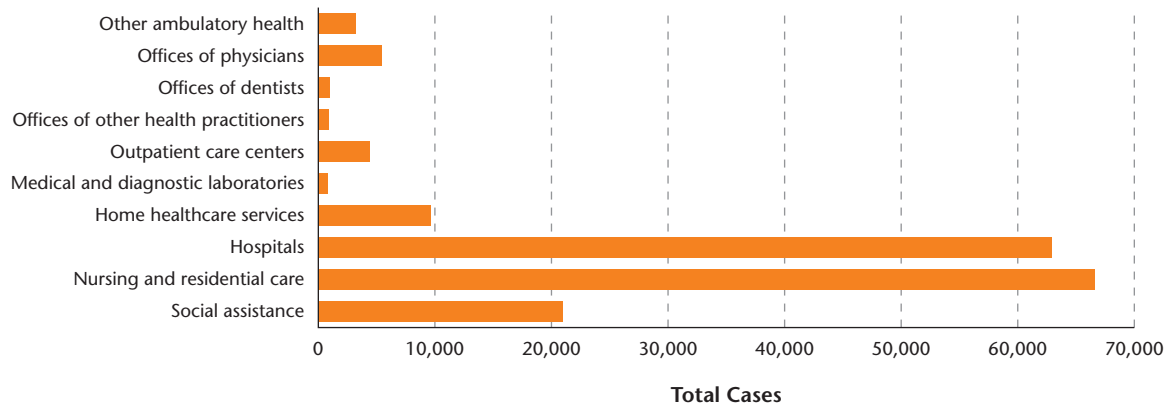
Classroom Management
Circulate among the students and check that they are selecting appropriate graphs and are choosing the correct data for the independent axis.

Occupational Injuries in Hospitals, 2005



The other should be a two-variable set, best represented by a bar graph or scatter graph.

Occupational Injuries and Illnesses, 2005



Have the students discuss with their groups how they can best illustrate each data set. After they have selected the best way, ask them to use the

Injury Trends

LESSON 2.1

appropriate worksheet to make rough graphs. Working as a group, have them decide how to make a legend and how they want to label the data so the graph is easy to read.

Students will have time to finish their visual aids outside of class. The main focus of this exercise is for them to choose an appropriate representation and then make it as easy to understand as possible.

Tell students that in this lesson, they will make graphs that would help workers and employers better understand the need to take workplace injuries seriously. Ask students to suggest some types of statistics that might be relevant regarding workplace injuries in the industry their group chooses. In addition, ask students to list the common injuries or illnesses that occur in the workplace that they share, their school. Later in this lesson, students will begin the process of collecting data and creating a clear presentation about school-related injury incidence rates. Some school-related injuries could be slips and strains, sports-related injuries, physical and mental effects of grade-related stress or stress from threats of violence, injuries from bullying or violent attacks, injuries from carrying heavy backpacks, bruises from jostling in overcrowded hallways, and so on.

Have students search the Internet for information on workplace injuries for an industry that interests them. Encourage some students to consider the healthcare industry as one good choice. Students can start by looking on the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) website (<http://www.osha.gov/oshstats>) or the Bureau of Labor Statistics website (<http://data.bls.gov/GQT/servlet/InitialPage>). Each group of students should select a set of data they feel illustrates an important point about workplace safety.

School Surveys

Then have students survey as many employees at the school as possible to get a sample incidence rate for common injuries. Remind students that in this case students are also “employees” of the school, and an adequate sample is as random as possible. Each student should be able to collect at least 40 responses by the next class, when they will create their graphs. They can record their data on the worksheet provided.

Have students go to <http://data.bls.gov/GQT/servlet/InitialPage> and search for injury rate data for all elementary and secondary schools in your state. They should record the incidence numbers of the most common injuries listed on the website, as they will also be creating graphs on these data in the next class.

Lesson Development—Day 2

Have students present their graphs from the previous session and ask other students to critique whether they are easy to understand. After students make their presentations, discuss what made the better visual aids successful. Ask the class to volunteer some of the ideas they would like to use in their finished products.

Injury Trends

LESSON 2.1

Ask students to take out the data they found online yesterday, as well as the survey data collected about school injuries. In the computer lab, have students open Microsoft Excel. On the screen, demonstrate how to enter a data set and then ask students to enter their own data sets (the data found with Internet research and the survey data) into new spreadsheets. Demonstrate how to use the chart wizard to create a chart, and then ask students to create their own charts, giving them enough time to do so. Circulate among the students to help them accomplish their goals.

Lesson Closure

Students can present their graphs to the class and offer their own interpretation of the data. The class then offers constructive criticism about the clarity of the information presented and the reasoning behind the interpretation.

Have students reflect on the results of their survey on school-related injuries. Did anything surprise them? Would any of the data be surprising and/or useful to administrators of the school? Ask students to compare the injuries they researched in their surveys to the data collected on schools across the state. Discuss any surprises that may come up. If appropriate, students can choose graphs that they think would be beneficial to either present to the school administration or post in the hallway for other students to see.

Student Assessment Artifacts

Completed handmade charts
Completed Excel charts

Possible Prior Misconceptions

Students may not realize how much thought goes into making data accessible through a chart or graph and may be tempted to create a chart with labels that are difficult to understand.

Variations and Extensions

When the students have completed their Excel charts, ask them to present their on-screen charts to the class for critique. You can then have the students explain the decisions they made and why they made them.

National and State Academic Standards

NATIONAL
NCTM Standards for School Mathematics

Data Analysis and Probability

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
- Understand histograms, parallel box plots, and scatterplots and use them to display data

CALIFORNIA
Mathematics Content Standards

Statistics

- 8.0 Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.

National and California Career Technical Education Standards

NATIONAL
NCHSTE National Healthcare Skill Standards

- 4.24 Interpret technical materials used for healthcare practices and procedures

CALIFORNIA
Health Science and Medical Technology Standards

- 4.5 Know how to interpret technical materials and medical instrumentation used for healthcare practices and policies

Name _____ Date _____ Period _____

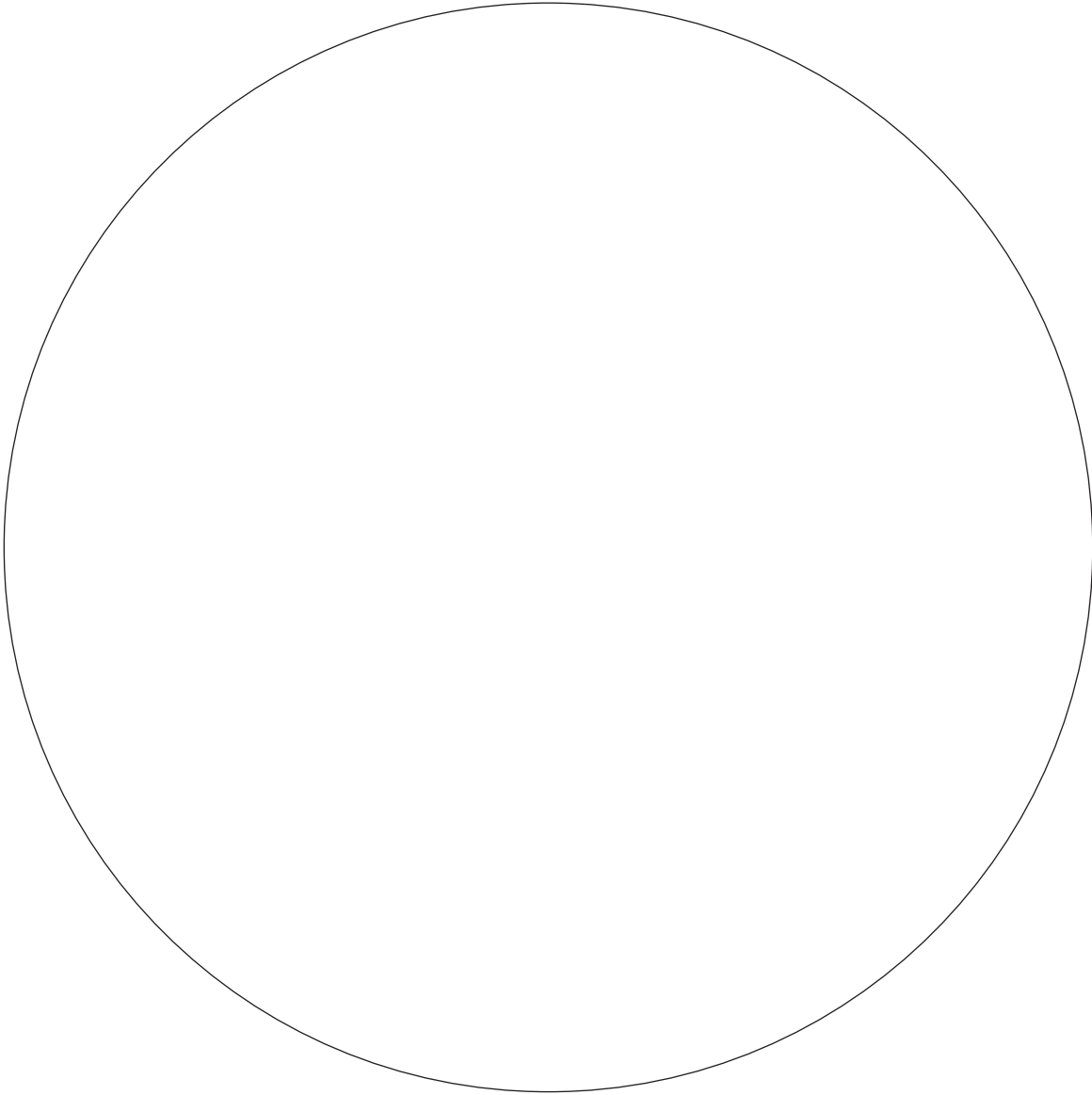
Work-Related Injuries Data

| Industry | Part of Body Affected by the Injury or Illness | | | | | | |
|---------------------------------------|--|-------|------|-------|--------|--------|----------|
| | Total Cases | Head | | | Trunk | | |
| | | Total | Eyes | Neck | Total | Back | Shoulder |
| Ambulatory healthcare services | 25,390 | 1,000 | 270 | 570 | 8,970 | 6,610 | 1,220 |
| Offices of physicians | 5,420 | 380 | 120 | 200 | 1,380 | 940 | 240 |
| Offices of dentists | 1,010 | – | – | – | – | – | – |
| Offices of other health practitioners | 900 | – | – | – | 140 | 120 | – |
| Outpatient care centers | 4,380 | 190 | – | 30 | 1,230 | 850 | 180 |
| Medical and diagnostic laboratories | 840 | 60 | 20 | 20 | 240 | 220 | 20 |
| Home healthcare services | 9,660 | 290 | 50 | 240 | 4,480 | 3,390 | 500 |
| Other | 3,180 | 70 | 50 | 60 | 1,390 | 1,000 | 280 |
| Hospitals | 62,930 | 2,650 | 880 | 1,320 | 28,790 | 20,380 | 4,950 |
| Nursing and residential care | 66,620 | 3,110 | 810 | 1,050 | 31,040 | 22,680 | 4,100 |
| Social assistance | 20,960 | 1,310 | 370 | 510 | 6,660 | 4,390 | 1,230 |

Name _____ Date _____ Period _____

Pie Chart

Title: _____



Subunit 2—Workplace Safety

Understanding the Law

LESSON 2.2

ENGLISH LANGUAGE ARTS

Time

100 minutes

Materials

Equipment

Computer lab with Internet access

Resources

- U.S. Department of Labor website (<http://www.dol.gov>)
- OSHA website (<http://www.osha.gov>)

Prior Student Learning

Students should have completed the math lesson on graphing and collected data on school-related injuries.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Read government regulations for understanding and summarize the key ideas.
- Write a concise explanation of child labor laws, adapting the writing style and information included to suit the intended audience.
- Determine whether a school site or other workplace is satisfying government regulations through a thorough search for and close reading of relevant laws.

Lesson Activities

Lesson Springboard

The Fair Labor Standards Act (FLSA) was first adopted in 1938 and establishes minimum wage requirements and protective child labor laws. The child labor laws pertain to anyone who is employed and is under the age of 18. Discuss how child labor laws are linked to workplace injuries, and ask students whether they know their legal rights and responsibilities as a child laborer.

Unit

Organization

This lesson provides important knowledge used in the unit's culminating event, detailed in Lesson 3.4.

Tell students that, in order to understand and follow the laws that are relevant to their lives, it is sometimes important to read the law itself, instead of relying on someone else's interpretation of it. Unfortunately, legal language is often dry and difficult to understand. This lesson gives students practice in reading complicated documents for meaning and summarizing relevant information.

Lesson Development—Day 1

Class Discussion

Either have students access the FLSA sections on child labor from the Internet, or hand out copies of the relevant regulations (see http://www.dol.gov/dol/allcfr/ESA/Title_29/Part_570/toc.htm).

Especially relevant are the sections involving the employment of minors between the ages of 14 and 16. Students should read the actual legal document and not the summaries written for the general public; the class will be creating their own summaries without looking at examples.

Have students attempt to read the child labor regulations involving wages and working hours. If necessary, divide the class into small groups

Understanding the Law

LESSON 2.2

and ask each group to work on one subsection of the law. A useful strategy for understanding complicated texts is to try and rephrase the content in your own words. Give students time to translate the relevant information in their subsection into a more understandable form. Assume that the audience for these summaries is students who are similar to those in the class.

Students can then share what they understood from the regulations with the class, and the class can evaluate the clarity of each student's summary. The instructor, who has read the entire document, can be in charge of checking the summaries for accuracy. Discuss the style in which the document is written and what specifically makes it hard to understand. Why did the authors construct the document this way? When creating their summaries, what information was omitted and why? If a summary were written for a different audience, such as parents or employers, how would the writing style and information included be different?

Small-Group Work

In their groups, have students create brochures that summarize the important information about child labor. Students will create individual brochures, but each small group will share a target audience: employees who are minors, parents, school counselors, employers in nonagricultural workplaces, or employers in agricultural workplaces. You may also want to include employees who are minors or adults and are just learning English as additional target audiences. Students should tailor the contents, their writing style, and the layout of the brochure to best meet the needs of their intended audience.

These targeted brochures can be completed as **homework**.

Lesson Development—Day 2

Internet Research

In the last class, students read and summarized a complex government regulation. Today they will search for government regulations that apply to their personal experiences with workplace injuries. Have students think about a job (paid or volunteer) that they currently have or have had in the past. What are the common workplace injuries that occur in that job? If students have not had a regular job, they can use the time they spend at school as their example. Remind students that they surveyed people about common school-related injuries in math class, and have students choose a school-related injury that most interests them.

Have students research the workplace- or school-related injury of their choice using the Internet or library resources. What are the current government regulations and safety suggestions that are relevant to that injury? What is the incidence rate of that injury for the industry sector and for the entire American workforce? Students should be familiar with at least the statistical research from the math lesson. When students have found the relevant government regulations (usually from OSHA), have them do a close reading of the law and determine whether the company they work for is satisfying its regulatory obligations, in their opinion.

Understanding the Law

LESSON 2.2

Lesson Closure

In small groups, have students share their findings and support their opinion about how well their workplace is maintaining safety standards. Allow the other group members to offer constructive criticism about the thoroughness of the research on relevant regulations and the effectiveness of the evidence used to support the student's opinion. After everyone has finished sharing, each student can write a one-page summary of the workplace injury they commonly witness or experience, the government regulations pertaining to the prevention of that injury, and evidence supporting the student claim of whether the workplace is satisfying the law.

Students can use the research done in this lesson for the concluding English Language Arts lesson, in which they make a presentation on workplace injuries commonly found in specific industry sectors.

Possible Prior Misconceptions

Students may believe that legal documents and regulations are inaccessible to the public or impossible to understand without a law degree.

Students may have an inaccurate view of the legal profession and not know that lawyers spend a lot of their time reading legal documents like those in this lesson.

Student Assessment Artifacts

Informational brochure on child labor laws

One-page summary of regulations about a specific workplace injury occurring in a company

Variations and Extensions

This lesson can be paired with a social science lesson on the creation of laws such as the Fair Labor Standards Act of 1938.

Invite a workplace injury lawyer to be guest speaker and address the laws and regulations commonly used in that type of legal practice.

Invite a youth advocate as a guest speaker to offer opinions about current child protection labor laws and work safety regulations and how they might be improved.

Understanding the Law

LESSON 2.2

National and State Academic Standards

NATIONAL

NCTE Standards for the English Language Arts

1. Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).
4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
8. Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
12. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

CALIFORNIA

English Language Arts Content Standards

Reading

- 2.1 Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.
- 2.7 Critique the logic of functional documents by examining the sequence of information and procedures in anticipation of possible reader misunderstandings.

Writing

- 1.1 Establish a controlling impression or coherent thesis that conveys a clear and distinctive perspective on the subject and maintain a consistent tone and focus throughout the piece of writing.
- 1.2 Use precise language, action verbs, sensory details, appropriate modifiers, and the active rather than the passive voice.
- 1.3 Use clear research questions and suitable research methods (e.g., library, electronic media, personal interview) to elicit and present evidence from primary and secondary sources.
- 1.4 Develop the main ideas within the body of the composition through supporting evidence (e.g., scenarios, commonly held beliefs, hypotheses, definitions).

Subunit 2—Workplace Safety
Sound Safety
LESSON 2.3

ALGEBRA II

Time

50 minutes

Materials

Equipment

- Calculators
- Graph paper

Resources

- OSHA Permissible Noise Exposure chart
- Sound Levels and Human Response chart
- Sound Safety worksheet

Prior Student Learning

Students should already be familiar with the rules of exponents and logarithmic notation.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Apply the concept of logarithms to convert the intensity of sound in pascals (Pa) into decibels (dB).
- Add and subtract decibels by manipulating their equivalent exponential expressions.
- Read and correctly apply the mathematical instructions in a technical document concerning noise in the workplace.
- Describe the basic shape of a logarithmic graph.

Lesson Activities

Lesson Springboard

Hearing damage is one of the most commonly reported workplace injuries, especially in manufacturing plants, construction sites, cafeterias, and farms. You can tell whether your workplace is loud enough to risk hearing damage if

- People must consistently raise their voice or yell to be heard.
- People leave work with ringing in their ears.
- People have to turn their car radios on louder after work than they do before work.
- After working in the environment for a long time, people have trouble understanding conversations held at restaurants or parties where there is a lot of competing noise.

(Source: http://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html)

OSHA has developed regulations on the level of noise a person can be exposed to before hearing protection must be provided by the employer. Ask the class to imagine that they are the Health and Safety team at a manufacturing plant. There is a plan to add new machinery to an existing production line and remove obsolete machinery. How can the amount of increased noise that the new machines contribute be calculated? How can the team determine how much the decibel level is reduced by taking away the old machines?

Lesson Development**Direct Instruction**

Students are usually familiar with the term *decibels* when talking about noise levels, but do not know what it actually means. A decibel is a tenth of a *bel*, which is the logarithmic expression of the ratio of a measured level of something to its reference measurement. Since bels and decibels have no units associated with them, they can be used to describe any measurable quantity as long as there is a reference value. (Decibels are also used to describe voltage and resistance in electronic applications, but the term is most widely used in the measurement of sound pressure.)

Sound is created when something makes the air around it vibrate. These vibrations are detected by your ears and are interpreted by your brain as a noise. Sound pressure can be thought of as the intensity of the vibration a sound creates—the greater the sound pressure, the louder the sound. Sound pressure is measured in pascals (Pa). The softest sound that a healthy young person can hear is 0.00002 Pa, while a painfully loud sound measures 20 Pa. This is a wide and cumbersome range of numbers to work with, so these measurements are converted into decibels (dB) to make it more manageable. The reference value for sound pressure levels is 0.00002; in other words, when decibels are used, all sound pressures are expressed in comparison to the softest sound you can hear.

To be completely accurate, sound pressure levels are calculated using the square of the ratio, but the scientific reasoning behind that is beyond the scope of this lesson. To make the math more manageable, we will use a simpler form of the equation that gives accurate answers for relative sound pressure changes, although it does not work when figuring out actual pressures in pascals.

Sound pressure level in bels is the log of the ratio of the sound pressure to the reference value. One bel equals 10 decibels.

$$\text{bels} = \log_{10}(\text{pressure ratio})$$

$$\text{decibels (dB)} = 10\log_{10}(\text{pressure ratio})$$

Have students convert the logarithmic equations into exponential equations.

Individual/Small-Group Work

Hand out the Sound Levels and Human Response chart and allow students time to fill out the missing column. Circulate to make sure that all students can correctly switch from logarithmic to exponential expressions, and make sure they have a conceptual understanding of the growth rate on the logarithmic scale before moving on with the lesson.

Hand out the Sound Safety worksheet and the OSHA Permissible Noise Exposure chart. The chart will be needed to answer some of the questions on the worksheet. Individuals or groups can now begin answering the questions. Students should realize that it does not make sense to add two decibel values together when two machines are in the same room.

(Some teachers introduce the mnemonic CADET: “Can’t Add—Don’t Even Try.”) Give the class time to work with the logarithms and come up with sensible answers. It may be necessary to guide the class through an example of converting decibels to pressure ratios, adding the two ratios together, and then reconverting to decibels. However, it is more meaningful to students to reason out the solution by themselves.

Problem 6 asks students to read a technical passage for meaning. Inform the class that this is the actual OSHA regulation regarding noise exposure. If they were real safety experts in the field, they would be required to read and understand documents like this all the time.

Problem 8 asks students to produce a graph. Because several data points should be calculated in order to produce an accurate curve, it might be more efficient for each group of students to calculate only one or two data points and then pool their results with the rest of the class to make the graph. Ask the class whether the graph ever hits the x -intercept, and why. Notice that when one machine produces noise 10 or more decibels lower than the other, it contributes virtually nothing to the combined noise production of the two machines. Ask the class to explain why that makes sense.

For problem 8, a table of values is included for teacher reference.

Lesson Closure

Allow students to compare their graphs with others to check for accuracy. Have students share their answers for problem 6, and have the class comment on how the student rewording made the information more clear. Ask students to think of other situations where converting into a logarithmic scale would be more convenient.

Possible Prior Misconceptions

Students may not realize the rate of exponential growth or decay and how it relates to corresponding logarithmic values.

Student Assessment Artifacts

Completed Sound Level and Human Response chart
Completed Sound Safety worksheet with graph

Variations and Extensions

Expand the lesson to review the rules of exponents and derive the rules of logarithms from them.

Include a discussion of the Richter scale and earthquake magnitude, perhaps in the context of building safer workplaces.

Borrow a sound meter and have students measure the sound levels in their school environment.

National and State Academic Standards**NATIONAL
NCTM Standards for School Mathematics***Algebra*

- understand relations and functions and select, convert flexibly among, and use various representations for them;
- analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior;
- understand and perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more-complicated symbolic expressions;
- understand and compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions
- identify essential quantitative relationships in a situation and determine the class or classes of functions that might model the relationships;
- use symbolic expressions, including iterative and recursive forms, to represent relationships arising from various contexts;
- draw reasonable conclusions about a situation being modeled.

**CALIFORNIA
Mathematics Content Standards***Algebra II*

- 11.0 Students prove simple laws of logarithms.
 - 11.1 Students understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
 - 11.2 Students judge the validity of an argument according to whether the properties of real numbers, exponents, and logarithms have been applied correctly at each step.
- 12.0 Students know the laws of fractional exponents, understand exponential functions, and use these functions in problems involving exponential growth and decay.
- 13.0 Students use the definition of logarithms to translate between logarithms in any base.
- 14.0 Students understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values.

Name _____ Date _____ Period _____

OSHA Permissible Noise Exposure Chart

| Permissible Noise Exposures ¹ | |
|--|----------------------------------|
| Duration per day, hours | Sound level dBA slow response |
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1 1/2 | 102 |
| 1 | 105 |
| 1/2 | 110 |
| 1/4 or less | 115 |

¹When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C_1/T_1 + C_2/T_2 + C_n/T_n$ exceeds unity, then the mixed exposure should be considered to exceed the limit value. C_n indicates the total time of exposure at a specified noise level, and T_n indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

Source: OSHA Regulations (Standards, 29 CFR) Occupational Noise Exposure, 1910.95.

Name _____ Date _____ Period _____

Sound Levels and Human Response

| Common Sounds | Noise Level (dB) | Number of Times Louder Than 10 dB | Effect |
|--|------------------|-----------------------------------|---|
| Rocket launching pad (no ear protection) | 180 | | Irreversible hearing loss |
| Carrier deck jet operation | 140 | | Painfully loud |
| Air raid siren | | | |
| Thunderclap | 130 | | |
| Jet takeoff (200 ft) | 120 | | Maximum vocal effort |
| Auto horn (3 ft) | | | |
| Pile driver | 110 | | Extremely loud |
| Rock concert | | | |
| Garbage truck | 100 | | Very loud |
| Firecrackers | | | |
| Heavy truck (50 ft) | 90 | | Very annoying Hearing damage (8 Hrs) |
| City traffic | | | |
| Alarm clock (2 ft) | 80 | | Annoying |
| Hair dryer | | | |
| Noisy restaurant | 70 | | Telephone use difficult |
| Freeway traffic | | | |
| Business office | | | |
| Air conditioning unit | 60 | | Intrusive |
| Conversational speech | | | |
| Light auto traffic (100 ft) | 50 | | Quiet |
| Living room | | | |
| Bedroom | 40 | | |
| Quiet office | | | |
| Library | 30 | | Very quiet |
| Soft whisper (15 ft) | | | |
| Broadcasting studio | 20 | | |
| | 10 | | Just audible |
| | 0 | | Hearing begins |

Source: Noise Pollution Clearinghouse, <http://www.nonoise.org>

Name _____ Date _____ Period _____

Sound Safety

Remember to show all work in an organized way when answering these problems.

Imagine that you are part of the Health and Safety team at a large manufacturing plant. The Engineering team is currently planning to add new machinery and replace obsolete machines in the production line. They ask you to analyze the plan for any safety hazards, including noise exposure.

$$\text{decibels (dB)} = 10\log_{10} (\text{pressure ratio})$$

1. The engineers have a choice between a machine that produces 68 dB and one that produces 71 dB of noise. Is one machine significantly louder than the other? If so, then by what factor?
2. Production Room A has a machine that produces 82 dB of noise. If another machine is added that produces 86 dB of sound, what will be the new sound level in the room?
3. Production Room B currently houses only manual tasks and has a sound level of 65 dB. If a machine that produces 80 dB of noise is added to automate the process, what is the new sound level of the room?
4. Production Room C has three machines in it. The level of noise in the room is 88 dB. When machine X is taken out, the overall noise level drops to 86 dB. What is the noise production of machine X?
5. Engineers would like to place as many robots in a row as possible in one room. Each robot produces 79 dB of noise. How many robots can be put in the room without having the overall noise level above 90 dB?
6. Read the footnote at the end of the Permissible Noise Exposures chart. Translate its meaning into your own words.
7. Workers usually spend 2 hours per 8-hour shift in a room that has 95 dB of noise. How much time can they spend in a 92 dB room without going over the required threshold of noise exposure?
8. The Health and Safety team decides that they don't want to do all of these calculations the next time new machinery is installed. They ask you to produce a graph that shows the resulting sound level from putting two machines together given the difference between the decibels those machines produce. Make the difference in decibel levels the independent variable, and the resulting combined decibel level the dependent variable.

Name _____ Date _____ Period _____

Sound Safety—Teacher Notes Data for Problem 8

| Numerical Difference Between Two Noise Levels (dB) | Amount to Be Added to the Higher of the Two Noise Levels (dB) |
|--|--|
| 0 | 3.0 |
| 0.1 | 2.961 |
| 0.5 | 2.767 |
| 1.0 | 2.539 |
| 2.0 | 2.124 |
| 3.0 | 1.764 |
| 4.0 | 1.455 |
| 5.0 | 1.193 |
| 6.0 | 0.973 |
| 7.0 | 0.790 |
| 8.0 | 0.639 |
| 9.0 | 0.515 |
| 10.0 | 0.414 |
| 20.0 | 0.04 |
| 30.0 | 0.004 |
| 40.0 | 0.0004 |

Persuasion, Propaganda, and the Public Image

LESSON 2.4

ENGLISH LANGUAGE ARTS

Time

90 minutes

Materials

- *Frontline* transcript: “A Dangerous Business” (<http://www.pbs.org/wgbh/pages/frontline/shows/workplace/etc/script.html>)
- McWane Health and Safety Policies (<http://www.mcwane.com/health.htm>)
- *New York Times* “Dangerous Business” series (http://www.nytimes.com/ref/national/DANGEROUS_BUSINESS.html)

Prior Student Learning

Students should have a general understanding of how to create workplace documents.

Students should have experience in evaluating and selecting appropriate evidence.

Students should know how to use propaganda (emotional appeals) in argumentation.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Distinguish between denotative and connotative meaning in written language.
- Identify how word choice can affect the meaning of text.
- Recognize and use a variety of propaganda techniques (emotional appeals) in written and oral arguments.

Lesson Activities

Lesson Springboard

Read the following workplace scenario to the students:

You are working in a manufacturing plant. This plant is one of the largest and most profitable plants in the country. Unfortunately, as in all large manufacturing plants, people sometimes get injured on the job. According to other workers, too many people get injured in this particular plant.

It is Monday. You find out that last Friday one of your close friends and a very popular worker got injured and will not be able to return to work. There is a lot of debate among your fellow workers—should the plant be shut down until the owners fix or replace some of the old machinery? The workers are divided into two factions, those who want to shut the plant down and those who want it kept open.

You need this job. You have bills to pay. You work with the machinery and know it is often dangerous. Your union is going to take a vote on Friday to see if the workers want to go on strike.

Ask two or three students for their opinions about the scenario and whom they feel is responsible for workplace accidents.

Lesson Development

Direct Instruction

Introduce the importance of careful word selection when attempting to sway an audience. Explain that writing can have both denotative and connotative meaning. *Denotative meaning* is literal meaning. For example, the denotative meaning of a word is the definition you might find in the dictionary. *Connotative meaning* is the emotion and feeling that is invoked by the word.

Persuasion, Propaganda, and the Public Image

LESSON 2.4

Tell students that the use of strong connotations can be an effective tool when writing to actively influence opinion. Make them aware that the deliberate manipulation of emotion is a characteristic of propaganda and that, historically, propaganda techniques have been used to further various political, commercial, religious, and civil causes. Tell them that effective propaganda often attempts to strike a balance between evocation of emotion and appeals to reason. Explain that some common propaganda techniques include the following:

- **Name-calling**—Attaching a negative label to a person or thing. This technique is used to tear down opponents without having to support one's own position.
- **Glittering generalities**—Using important-sounding “glad words” that have little or no real meaning in general statements that cannot be proved or disproved. This technique is essentially the opposite of name-calling. Words like “good,” “honest,” “fair,” and “best” are examples of “glad” words.
- **Transfer**—The attempt to transfer the prestige of a positive symbol to a person or an idea. Using the American flag as a backdrop is a common transfer technique in U.S. politics.
- **Fear**—Playing on the audience's deep-seated fears to redirect attention in the desired direction. Insurance companies provide detailed information on disasters as a fear appeal to sell insurance policies.
- **Testimonial**—Using famous personalities to endorse a product. Celebrity endorsements in advertising are the most common example of testimonials.
- **Card stacking**—Omitting key information in order to slant a message. This term comes from stacking a deck of cards in your favor.
- **Bandwagon**—Encouraging the mindset that because everyone else is doing something, you should do it, too, or you'll be left out. The technique embodies a “keeping up with the Joneses” philosophy.
- **Either/or fallacy**—Providing the audience with only two choices. This is sometimes called “black-and-white thinking.” You are either for something or against it; there is no middle ground or shades of gray. It is used to polarize people's thinking on issues and negates all attempts to find a common ground.

Have students learn about McWane, Inc. by reading “Do It Safely or Not at All,” the McWane health and safety policy statement, and “A Dangerous Business,” the transcript of a FRONTLINE investigation of the company (additional information about the McWane case can be found at http://www.nytimes.com/ref/national/DANGEROUS_BUSINESS.html). Decide whom you think is responsible for workplace accidents. Ask students to find information from the articles that supports their point of view. Have each team of students create a flyer that expresses their view and will convince the media and employees or employers that their position is correct.

Persuasion, Propaganda, and the Public Image

LESSON 2.4

Brochure Project

Have students create a flyer that expresses their position and that will persuade the media and employees or employers to adopt their perspective. Teams can finish the flyer in class, and then go to the computer lab and create an electronic version of the flyer or complete the flyer as **homework**.

Lesson Closure

Ask students how many brochures or flyers they have received in the mail or that have been handed to them on the street. Then ask how many of them have read an entire brochure or flyer cover to cover. Ask them to describe some of the factors that compelled them to keep reading or led them to stop. Explain that in today's society people often have a very short time to get their message across; this is why the language and graphics used must be clear, concise, and engaging.

Possible Prior Misconceptions

Students may believe that all responsibility for workplace accidents falls on the employee, or conversely on the employer.

Student Assessment Artifacts

Completed brochure or flyer

Variations and Extensions

When learning about propaganda, ask students to identify examples of various techniques being used in the contemporary media. Some possible suggestions include coverage of recent political events, advertising, and promotion of popular culture.

Persuasion, Propaganda, and the Public Image

LESSON 2.4

National and State Academic Standards

NATIONAL

NCTE Standards for the English Language Arts

1. Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

CALIFORNIA

English Language Arts Content Standards

Reading

- 2.1 Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.
- 2.4 Synthesize the content from several sources or works by a single author dealing with a single issue; paraphrase the ideas and connect them to other sources and related topics to demonstrate comprehension.
- 2.5 Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration.

Writing

- 1.1 Establish a controlling impression or coherent thesis that conveys a clear and distinctive perspective on the subject and maintain a consistent tone and focus throughout the piece of writing.
- 1.8 Design and publish documents by using advanced publishing software and graphic programs.

Listening and Speaking

- 1.7 Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.

Treatment, Rehabilitation, and Related Occupations

LESSON 2.5

HEALTH SCIENCE

Time

100 minutes

Materials

Equipment

Masking tape

Resources

- Information about careers related to treatment and rehabilitation of work-related injuries (<http://www.iseek.org/sv/12000.jsp?code=08>)
- Treatment and Rehabilitation Occupations worksheet
- Treatment and Rehabilitation Plan

Prior Student Learning

Students should already be familiar with common types of workplace injuries and prevention strategies from previous lessons in this unit.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Define *rehabilitation*.
- Describe healthcare occupations that are related to workplace injuries and rehabilitation.
- Understand the importance of correct diagnosis, treatment, and rehabilitation for workplace injuries.
- Define patient compliance and give examples of teamwork between healthcare providers and their patients.
- Develop a treatment and rehabilitation plan for a fictional patient.

Lesson Activities

Lesson Springboard

Ask students to share experiences about any injuries they may have suffered that hindered their regular daily tasks or duties. Discuss the inconvenience and discomfort of recovery, and imagine what it must be like to recover from an injury while trying to stay productive at a paying job. Inform students that this lesson will give an overview of treatment and rehabilitation plans for patients injured on the job. It will also give students a chance to think about careers related to treatment and rehabilitation.

Unit

Organization

This lesson provides necessary knowledge for the culminating event, detailed in lesson 3.4.

Lesson Development

Class Activity

Distribute approximately two feet of masking tape to each student. It is often more manageable to give each student two one-foot pieces. Demonstrate wrapping the tape tightly around the palm of the hand and the thumb several times so that both thumb and palm are fairly immovable. Students should tape their dominant hand. Tell the class that the tape is simulating a temporary disability resulting from a minor on-the-job injury, and that students will have to perform their normal duties (e.g., take notes) while impaired. While they are taking notes, ask students to think about what it feels like to lack a fully functioning hand. (If the tape becomes too painful or uncomfortable, students may take it off at any time during the lecture.)

Treatment, Rehabilitation, and Related Occupations

LESSON 2.5

Direct Instruction

The following information about the diagnosis, treatment, and rehabilitation of injuries should be included in a lecture.

- **Types of first aid administered at the workplace.** Examples are icing sprains, bandaging cuts and wounds, washing out eyes after a chemical splash, simple immobilization of a possible fracture.
- **Home treatments (while still under a doctor's supervision).** These include NSAID drugs, elevation, ice, and rest.
- **Types of injuries that require emergency care at a hospital.**
- **Typical values of vital signs when someone goes to the hospital when injured,** such as blood pressure, breathing rate, and pulse.
- **Diagnostic tests.** These include blood tests, MRIs, X-rays, urine tests, physical examinations.
- **Treatments.** *Medical treatment* is the administration or application of remedies to a patient or for a disease or injury. Outline medical treatments (as opposed to home treatments), including prescription drugs, casting of fractures, splints, surgery, etc.
- **Rehabilitation.** *Rehabilitation* means the restoration of, or improvement in, a person's health and ability to perform normal job or life functions. Different types of rehabilitation include
 - *Physical therapy (PT)*—The treatment of physical dysfunction or injury by the use of therapeutic exercise, intended to restore or facilitate normal function or development of the body.
 - *Occupational therapy (OT)*—Therapy based on engaging in meaningful activities of daily life, especially to enable or encourage participation in such activities in spite of impairments or limitations in physical or mental functions.
 - *Chiropractic care*—A system of therapy in which disease is considered the result of abnormal function of the nervous system. The method of treatment usually involves manipulation of the spinal column and other body structures.
 - *Psychological care*—Group or individual counseling to promote, maintain, or regain mental health.

At this point students may take off the tape from their hands if they have not already done so. Ask volunteers to report on how it felt to be impaired for this short amount of time. Remind students that while some workers experience temporary injuries, others suffer permanent ones such as amputations, loss of hearing, or work-related asthma. Students can be asked to do a quick writing exercise about what it might be like to have a permanent disability and be a student at the school.

Treatment and Rehabilitation Occupations Research Activity

Pass out the Treatment and Rehabilitation Occupations worksheet to each student. Divide the class into pairs or small groups and have each group of students research two or three of the occupations. Job descrip-

Treatment, Rehabilitation, and Related Occupations

LESSON 2.5

tions and responsibilities should be limited to those related to treating and rehabilitating patients with job-related injuries or illnesses. When groups are done they can report their research to the class, providing students with the information to complete the rest of their worksheets. Descriptions and video clips of various healthcare professions can be found at <http://www.iseek.org/sv/12000.jsp?code=08>. The information students find will be used in the next activity.

Role-Play in Pairs

Ask students to take out their worksheets from the previous health science lesson that detailed situations leading to workplace injuries and their symptoms (Common Workplace Injuries and Illnesses Presentation Preparation worksheet, Lesson 1.1) This time, the partners in each pair will switch roles so that the patient during the first presentation is now the doctor, and vice versa.

Have students prepare a medical treatment and rehabilitation plan for a fictional patient with one of the injuries or illnesses they were assigned. This plan must include the different healthcare professionals who will be involved in the care of the patient and the roles they will play. The role-play should also address the important role the patient plays in the plan. Have each pair present their role-play to the class. Afterwards, discuss the teamwork necessary between healthcare professionals and their patients to produce a successful recovery.

Lesson Closure

Students can apply what they have learned to the specific injuries, industries, and companies they select for the cumulative event, if appropriate. Otherwise, they can write a reflection on the fictional patient they have role-played for the class. What was the patient's life like before the injury? How did it change with the injury, and how long will it take to come back to some sense of normalcy?

Possible Prior Misconceptions

Students may not be aware of the large number of diverse healthcare industry occupations that exist.

Student Assessment Artifacts

Student presentation on two or three healthcare occupations
Completed Treatment and Rehabilitation Occupations worksheet
Role-play of treatment and rehabilitation plan for fictitious patient
Written reflection on life before and after an injury

Variations and Extensions

Invite a panel of healthcare professionals to speak and answer questions about their daily job responsibilities, level of education and experience, and how they work together to treat patients.

Take a field trip to a rehabilitation center or other medical facility to observe healthcare teams working on patient recovery.

Treatment, Rehabilitation, and Related Occupations

LESSON 2.5

National and State Career Technical Education Standards

NATIONAL

NCHSTE National Healthcare Skill Standards

- 1.21 Compare selected diseases/disorders including respective classification(s), causes, diagnoses, therapies, and care/rehabilitation to include biotechnological applications
- 2.11 Adjust communication to other's ability to understand
- 2.25 Organize, write and compile technical information and summaries
- 2.26 Use medical terminology within a scope of practice in order to interpret, transcribe and communicate information, data and observations
- 3.31 Diagram the interdependence of healthcare professions within a given healthcare delivery system and pertaining to the delivery of quality healthcare
- 4.41 Explore a potential health science career path in at least one of the following healthcare services: diagnostic, therapeutic, information, or environmental
- 4.42 Consider levels of education, credentialing requirements, employment opportunities, workplace environments, and career growth potential for a service area

CALIFORNIA

Health Science and Medical Technology Standards

- 1.6 Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).
- 2.5 Know and understand medical terminology to interpret, transcribe, and communicate information and observations necessary for workers in the healthcare industry.
- 2.6 Know and understand the use of organizational channels and networks as a necessary means of communications.
- 3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.
- 3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.
- 9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.
- 9.3 Understand how to organize and structure work individually and in teams for effective performance and the attainment of goals.

Name _____ Date _____ Period _____

Treatment and Rehabilitation Occupations

Fill in the table with information from your textbook, other in-class resources, and the Internet.

| Occupation | Job Description and Responsibilities | Injuries and Illness Related to the Work of Professionals in This Field | Level of Education and Experience Required |
|------------------------------------|--------------------------------------|--|--|
| Biomedical Engineer | | | |
| Chiropractor | | | |
| Compliance Officer or Inspector | | | |
| Emergency Medical Technician | | | |
| General Physician | | | |
| Health Services Administrator | | | |
| Home Health Aide | | | |
| Licensed Practical Nurse | | | |

Name _____ Date _____ Period _____

| Occupation | Job Description and Responsibilities | Injuries and Illness Related to the Work of Professionals in This Field | Level of Education and Experience Required |
|---|--------------------------------------|---|--|
| Massage Therapist | | | |
| Medical Laboratory Technician | | | |
| Mental Health Counselor | | | |
| Nurse Practitioner | | | |
| Occupational Health and Safety Specialist | | | |
| Occupational Therapist | | | |
| Orthotic and Prosthetic Specialist | | | |
| Physical Therapist | | | |
| Registered Nurse | | | |

Name _____ Date _____ Period _____

Treatment and Rehabilitation Plan

Choose one of the injuries or illnesses that you were assigned earlier in the Common Workplace Injuries and Illnesses lesson to complete this worksheet.

Name: _____

Partner's Name: _____

Injury or Illness: _____

Diagnostic Tests, and what these tests are looking for:

Treatments (type, duration, necessary equipment) for this condition:

Home

Healthcare Professionals Involved

Outpatient Medical

Healthcare Professionals Involved

Inpatient Medical

Healthcare Professionals Involved

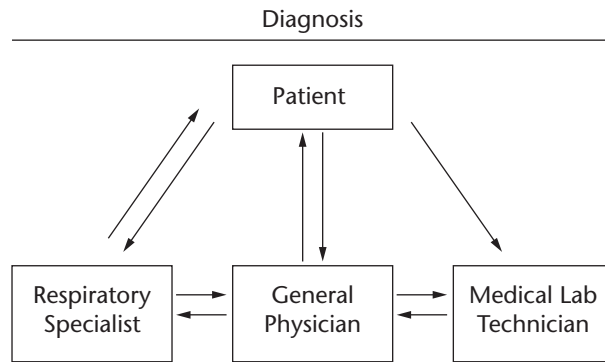
Rehabilitation (type, duration, necessary equipment) for this condition:

Healthcare Professionals Involved

Name _____ Date _____ Period _____

Create a map or visual representation of the healthcare team needed to treat and rehabilitate the patient with this injury or illness. Don't forget to include the patient in the team!

Here is an example. Your map can be in a different style, as long as it conveys information clearly. Your map will have more information than the example.



Taking Responsibility

SUBUNIT 3 OVERVIEW

Essential Question for This Unit

How can work-related injuries be reduced, and who should be responsible for implementing reduction strategies?

Subunit Goals

Subunit 3 focuses on the historical evolution of the American workplace and shifting perspectives on responsibility for work-related injuries. Students begin with a lesson on the effects the Industrial Revolution had on the work environment and workplace injuries. In the second lesson, they survey the progression of judicial cases related to workplace injuries from the early 19th century to the beginning of World War II. They then examine the shift toward greater social responsibility for workplace safety and the emergence of protective regulations. Finally, students conclude their work by synthesizing what they have learned throughout all three subunits and delivering a presentation about common workplace injuries in a specific industry.

Subunit Key Questions

- How did the Industrial Revolution change the workplace landscape? How did the incidence rate and type of work-related injuries change as a result of the Industrial Revolution? (World History)
- How have views about the responsibility for workplace injuries changed in the United States? How does the government protect workers? (U.S. History or U.S. Government)
- What injuries are common in specific industries, and what responsibilities do employers and employees have for reducing and treating them? (English Language Arts)
- What is the best way to inform and persuade an audience about workplace injuries—their prevention and treatment and the related legal requirements? (English Language Arts)

Lesson Summaries

| Lesson | Subject | Description |
|--------|---------------------------------|---|
| 3.1 | World History | Workplace Safety During the Industrial Revolution Students explore the social and economic consequences of the Industrial Revolution with a focus on working conditions and workers' rights. |
| 3.2 | U.S. History or U.S. Government | Burden of Responsibility: Past Students are introduced to important U.S. court cases from the 19th and early 20th centuries and asked to judge which party should be held responsible. They then learn the historical ruling and discuss the differences between current and past views on workplace injuries. |
| 3.3 | U.S. History or U.S. Government | Burden of Responsibility: Present Students examine the shifts toward greater regulation of the workplace environment and social rather than personal responsibility for accidents. They learn about the inception of OSHA and its present role, and they review the more stringent regulatory requirements that pertain to teen workers. |
| 3.4 | English Language Arts | Workplace Injury Presentation This lesson leads to the culminating event for the unit. In groups, students act as professionals in various health and safety fields who are asked to report on the most common injuries at a specific company. They then create a PowerPoint presentation, summary brochure, and an in-depth safety manual to inform employees about the prevention, diagnosis, and treatment of these injuries, as well as about relevant legal regulations and available resources. |

Workplace Safety During the Industrial Revolution

LESSON 3.1

WORLD HISTORY

Time

150 minutes

Materials

Equipment

TV and VCR/DVD player

Resources

- Video: *The Worst Jobs in History*—Season 2, Episode 3: “The Worst Industrial Jobs in History” (You may be able to tape this off the International History Channel, or order it from <http://shop.abc.net.au/browse/product.asp?productid=744984>)
- Information for group folders (<http://www.spartacus.schoolnet.co.uk/Twork.htm> and <http://www.spartacus.schoolnet.co.uk/IRchild.htm>)

Prior Student Learning

Students should have a general understanding of the Industrial Revolution in England.

Students should be familiar with the “laissez-faire” system of economic governance.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Identify the cause and effects of mass urbanization during the Industrial Revolution and its impact on public health.
- Present a 19th-century medical argument either supporting or opposing “laissez-faire” government policies during the Industrial Revolution in England.
- Describe the transmission, symptoms, and treatment for two Industrial Revolution-era workplace-related conditions: phossy jaw and mill fever (byssinosis).

Lesson Activities

Lesson Springboard

Begin the class with an explanation of the terms revolution, industry, and Industrial Revolution. Briefly discuss any industrial changes you have previously covered in class. Ask students to envision a world where workers are not protected by the government and to imagine a doctor who would argue that it is not dangerous for children to work 12 to 14 hours each day in unsafe, dirty factories.

Explain that a major change in social structures that occurred during the Industrial Revolution was the increase in child labor outside of the home. Previously, children had typically been included in daily family chores in agricultural areas or in family businesses as soon as they were capable, but during this time period they began to work for wages and for employers who were not family members.

Productivity and profit were goals of these employers and child laborers were a means to efficiently achieve those goals. Economic progress brought social injustices. Political influences were divided between supporting progress on the one hand, and correcting injustices that resulted from the new industrial labor practices on the other. Ask students to predict the impact of this kind of governmental behavior and policymaking on public health and worker safety.

Lesson Development

Students will be asked to play the role of a medical professional in 19th-century England who takes a stand on workplace safety and public health issues.

Classroom Management

Circulate among the students and check that they are examining both sides of the issue.

Workplace Safety During the Industrial Revolution

LESSON 3.1

Students will begin by gathering background information about types of industry and working conditions in the 1800s. As a class, they will watch the video segment on historical working conditions at a match factory in England.

Place students in groups of four to six and provide each group with a folder of Internet research documents, and information on illnesses and injuries. Students will be assuming the role of a medical doctor testifying during an 1888 investigation of the British Parliament Committee on Public Health and Safety concerning the problem of either mill fever or phossy jaw. Allow the groups to choose which testimony they will give. Have students use the testimony on textile factory working conditions as a model for their own testimonies. Remind students that they will be portraying doctors from 1888, when many supported the continuation of a laissez-faire, or “do-nothing,” approach. During class, and for **homework**, have students review and compose the final draft of their testimony (including finishing their PowerPoint presentation or poster).

Support Strategy
Allow students to work in pairs when writing their testimonies.

Mock Hearings

In a later class session, hold mock hearings where students will “testify” before the Committee on Public Health and Safety. The students in the audience will act as the members of Parliament. During the presentations, those playing members of Parliament will be able to ask questions of the testifying doctors, simulating a committee investigation. Remind students that they need to stay in character.

After all the doctors have testified, conduct a debrief on the session by having students participate in an open discussion on the entire lesson.

Lesson Closure

Ask students to review what they have learned and then write one to three paragraphs in which they compare their thoughts and feelings from before and after the lesson about how a medical professional could justify inaction on disease, injury, or illness. Considering all the testimony heard, ask students to speculate about the types of public health issues they might face in their future careers. Can they envision a scenario in which they might be asked to testify in front of Congress? Might they ever be asked to testify and face pressure to compromise their values?

Possible Prior Misconceptions

Students may believe that worker health and safety have always been important issues for society, businesses, and governments.

Student Assessment Artifacts

Written testimony
Oral presentation
PowerPoint presentation or poster

Workplace Safety During the Industrial Revolution

LESSON 3.1

Variations and Extensions

If students have sufficient time and computer access, they may be able to perform all of the research on their own. Have students visit several Industrial Revolution websites to explore workplace injuries from that time period, as students may not be familiar with those injuries.

Have students engage in a discussion about the Hippocratic Oath. Discuss whether a doctor's commitment should extend beyond individual patient care to public health and safety. Are there any situations when those two concerns might come into conflict?

Have students discuss what roles doctors and other health professionals currently play in society when it comes to public health and safety.

National and State Academic Standards

NATIONAL NCSS Curriculum Standards for Social Studies

VIII. Science, Technology, and Society

Social studies programs should include experiences that provide for the study of relationships among science, technology, and society, so that the learner can:

- a. identify and describe both current and historical examples of the interaction and interdependence of science, technology, and society in a variety of cultural settings;
- b. make judgments about how science and technology have transformed the physical world and human society and our understanding of time, space, place, and human-environment interactions;
- c. analyze how science and technology influence the core values, beliefs, and attitudes of society, and how core values, beliefs, and attitudes of society shape scientific and technological change.

CALIFORNIA History-Social Science Content Standards

World History

- 10.3 Students analyze the effects of the Industrial Revolution in England, France, Germany, Japan, and the United States.
 - 10.3.1 Analyze why England was the first country to industrialize.
 - 10.3.2 Examine how scientific and technological changes and new forms of energy brought about massive social, economic, and cultural change (e.g., the inventions and discoveries of James Watt, Eli Whitney, Henry Bessemer, Louis Pasteur, Thomas Edison).
 - 10.3.3 Describe the growth of population, rural to urban migration, and growth of cities associated with the Industrial Revolution.
 - 10.3.5 Understand the connections among natural resources, entrepreneurship, labor, and capital in an industrial economy.

Burden of Responsibility: Past

LESSON 3.2

U.S. HISTORY OR U.S. GOVERNMENT

Time

50 minutes

Materials

- You Be the Judge! handout
- You Be the Judge! answer key

Prior Student Learning

Students should have a basic knowledge of American history.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students will be able to

- Critically read a technical article.
- Compare divergent views on a leading scientific dispute.
- Write a well-reasoned editorial that supports an opinion with facts.

Lesson Activities

Lesson Springboard

How dangerous is work? By measuring the number of injuries or deaths occurring to a group of workers in one year, we can see that over the past century, work has become far safer everywhere in the developed world. One reason is that many jobs have shifted from relatively dangerous activities like farming, fishing, and manufacturing to services and retail trade. But this is not the whole story. Even the dangerous trades are far safer now than they were in 1900. In mining, for example, the fatality rate has fallen by a factor of 30 in the past hundred years.

Why has work become so much safer? The answer is more complex and a lot more surprising than you might think. It has to do not so much with the progress of technology as with a shift in our understanding of who is responsible for workplace injuries and what they owe to workers.

Lesson Development

Direct Instruction

Tell students that the United States was an especially dangerous place to work during the Industrial Revolution and throughout the 19th century. In some part, this was due to the nature of the work itself. For instance, American railroads hauled more freight than passengers and loading freight is quite hazardous. U.S. mines were also more dangerous than in Europe because many were open face rather than pit mines and hence blown open with dynamite. American factories relied more heavily on machinery because until about 1900 labor was scarce here in comparison to Europe, and the machines had few, if any, safeguards.

But there was another and more important reason for the thousands of workplace injuries that occurred in the U.S. every year. Injuries were “cheap” to the employer because, according to the law, accidents were the fault of employees themselves. A number of surveys around 1900 showed that only half of all fatally injured workers recovered anything and their average compensation amounted to half a year’s pay. When a

Burden of Responsibility: Past

LESSON 3.2

worker signed a contract, he or she agreed to shoulder the risk of injury or death on the job, and the courts enforced these contracts with few exceptions. Employees were free to sue their employer in court, but the odds were against them: the majority of cases that reached a judge were decided in favor of the employer.

Class Exercise: You Be the Judge!

Distribute the You Be the Judge! handout. Ask students how they would rule, if they were the judge, in these workplace-injury trials of the 19th and early 20th centuries. Allow time for discussion of each case. Encourage someone to take the employer's point of view, and if nobody volunteers, present the employer's case yourself. The goal of the exercise is to enter imaginatively into the 19th-century mind, and to do this, one must challenge the assumptions or prejudices of 21st-century students.

Direct Instruction

Despite laws that made employees responsible for almost every accident on the job, the courts were willing to hear cases, and when the accident was very obviously the employer's fault, to award large damages. Much depended on the judge and on juries, which could be unpredictable. Therefore, firms in the early 1900s faced a crapshoot. Facing an injured worker in the courtroom they were likely to win, but if they didn't win the costs could be enormous. In many cases, it depended on the jury—and juries were filled with farmers, factory hands, carpenters, and clerks.

Ask students what they think came out of this period of uncertainty. Remind them that workers were agitating for safety on the job; that unions were forming from the 1880s onward; and that politicians in the early 20th century were trolling for votes. By the presidency of Teddy Roosevelt, workplace safety had become a national issue.

After students have shared their thoughts, tell them that one solution was for states to tighten safety rules in many industries. But far more important were new laws that raised the cost of accidents to employers. In 1908, Congress passed a federal employers' liability law for railroad workers that sharply limited defenses an employer could claim. Worker fatalities that had once cost the railroads \$200 now cost \$2,000. Two years later, New York became the first state to pass a workmen's compensation law. This was a European idea. Instead of requiring injured workers to sue for damages in court and prove the employer was negligent, the new law automatically compensated all injuries at a fixed rate.

Workers' compensation was an insurance system: every company paid a few dollars per employee into a common fund to compensate injured workers. The rate they paid corresponded to the number of accidents in their industry. The new law appealed to businesses because it made costs more predictable and reduced labor strife. To reformers and unions it promised greater and more certain benefits. To employees it seemed fairer than the crapshoot of the courts, although it removed their chance for really big pay-outs in those rare cases when the court decided in their favor. Between 1911 and 1921, 44 states passed these compensation laws.

Burden of Responsibility: Past

LESSON 3.2

According to one historian, “The sharp rise in accident costs that resulted from compensation laws and tighter employers’ liability initiated the modern concern with work safety and initiated the long-term decline in work accidents and injuries.” Ask the class why this would be true. Workers’ compensation means that accidents are no longer regarded as an employee’s fault but as a normal outcome of work, and that the normal number of injuries or deaths can be predicted for any line of work. Does this make sense? Does it improve the earlier system where the courts were responsible in finding fault? How does it affect our notion of individual responsibility at work?

Students may accept or reject the idea of workers’ compensation. Let them discuss their views. Then tell them that the result of the new system was that large firms in railroading, mining, manufacturing, and elsewhere suddenly became interested in safety. Companies began to guard machines and power sources, while machinery makers developed safer designs. Managers began to look for hidden dangers at work and to require that workers wear hard hats and safety glasses. They also set up safety departments run by engineers and safety committees that included both workers and managers. In 1913, companies founded the National Safety Council to pool information. Government agencies such as the Bureau of Mines and National Bureau of Standards provided scientific support, while universities also researched safety problems for firms and industries.

Tell students that once the new system was in place, railroad employee fatality rates declined steadily after 1910. At large companies, such as DuPont, and in whole industries, such as steelmaking, safety also improved dramatically.

Lesson Closure

Work became much safer in America during the first half of the 20th century. Progress in technology accounted for some of this, for example, electrical lighting in factories and improved ventilation in mines. Even more important was a new way of thinking about accidents. Accidents on the job came to be seen as inevitable, a normal cost of doing business, and a collective responsibility. Employers financed this system of insurance, and since what they paid was determined by the accident rate in their industry, they had an incentive to make their workplaces safer.

Possible Prior Misconceptions

Students may believe that workplace safety is regulated only by the federal government. In fact, it is also regulated by state laws and union contracts, as well as by the pressure that the workers’ compensation system and the courts exert upon employers.

Student Assessment Artifacts

Class case discussions

Burden of Responsibility: Past

LESSON 3.2

Variations and Extensions

Have students find their own cases to analyze for You Be the Judge! They can present these to the class for judgment or write a one-paragraph analysis to hand in.

Students may interview lawyers, public officials, or accident victims who are involved in the workers' compensation system. What are the benefits and drawbacks of this system? Why has it become so expensive in states like California? How can the system be reformed?

National and State Academic Standards

NATIONAL **NCSS Curriculum Standards for Social Studies**

V. Individuals, Groups, and Institutions

- g. Analyze the extent to which groups and institutions meet individual needs and promote the common good in contemporary and historical settings;
- h. Explain and apply ideas and modes of inquiry drawn from behavioral science and social theory in the examination of persistent issues and social problems.

NCHS National Standards in World History

Era 7

The students in grades 5–12 should understand the causes and consequences of the agricultural and industrial revolutions, 1700–1850.

CALIFORNIA **History-Social Science Content Standards**

Historical Interpretation

1. Students show the connections, causal and otherwise, between particular historical events and larger social, economic, and political trends and developments.
2. Students recognize the complexity of historical causes and effects, including the limitations on determining cause and effect.
3. Students interpret past events and issues within the context in which an event unfolded rather than solely in terms of present-day norms and values.

World History

- 10.3 Students analyze the effects of the Industrial Revolution in England, France, Germany, Japan, and the United States.

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You Be the Judge!

Here are three cases from the 19th and early 20th centuries in which the courts had to judge who was to blame for injuries on the job. What is *your* judgment? What do you think was the court's judgment, and why?

The Case of the Master and the Fellow Servant
Adapted from Law in America: A Short History (L.M. Friedman, 2004)

In a Massachusetts case from 1842, a railroad worker named Nicholas Farwell suffered a terrible injury on the job. One day a switchman allowed a train to run off the track; Farwell was thrown to the ground and a wheel of the car crushed his hand. He sued the railroad, claiming that the negligence of another worker was the cause of his injury. Farwell's lawsuit rested on an old, established principle: that if an employee does something on the job that harms a co-worker (known as the "fellow servant") that co-worker could sue the employer (the "master") because the employer is generally responsible for the actions of the employees. The special wrinkle in the Farwell case was that *both* the man who did the damage and the man who suffered the injury were employees of a single company.

Who would you convict, the switchman, the railroad, or both? And what compensation would you give to poor Mr. Farwell? Who do you think the court convicted? And what compensation did it provide?

The Case of the Towering Inferno
http://en.wikipedia.org/wiki/Triangle_Shirtwaist_Factory_fire

In the early 1900s, the Triangle Shirtwaist Company employed approximately 500 workers in its factory on the top three floors of a 10-story building in Manhattan. They were mostly young immigrant women from Italy and Eastern Europe, some as young as 12 or 13. The women worked 60 to 72 hours per week, sewing clothes for a wage of \$1.50 per week.

The Triangle Shirtwaist Company had already become well-known outside the garment industry by 1911: the massive strike by women's shirtwaist makers in 1909, known as the Uprising of 20,000, began with a spontaneous walkout at the Triangle Company. While the International Ladies Garment Workers Union negotiated a collective bargaining agreement covering most of those workers after a four-month strike, Triangle Shirtwaist refused to sign the agreement.

The conditions of the factory were typical of the time. Flammable textiles were stored throughout the factory, scraps of fabric littered the floors, patterns and designs on sheets of tissue paper hung above the tables, smoking was common, illumination was provided by open gas lighting, and there were no fire extinguishers.

In the afternoon of March 25, 1911, a fire began on the eighth floor, sparked by either a lighted match or a cigarette. Most of the workers who were alerted on the tenth and eighth floors were able to evacuate. However, the warning about the fire did not reach the ninth floor in time. The ninth floor had only two doors leading out. One stairwell was already filling with smoke and flames by the time the seamstresses realized the building was ablaze. The other door had been locked to prevent workers from stealing materials or taking breaks and to keep out union organizers.

The single exterior fire escape, a flimsy, poorly anchored iron structure, soon twisted and collapsed under the weight of people trying to escape. The elevator also stopped working, cutting off that means of es-

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cape, partly because the panicked workers tried to save themselves by jumping down the shaft to land on the elevator's roof. Realizing there was no other way to avoid the flames, 62 of the women broke windows and jumped to the pavement nine floors below. The death toll was 146.

Were the Triangle Shirtwaist owners at fault here? If so, what punishment did they deserve? How would you compensate the survivors, or the families of the dead?

The Case of the Deadly Gasoline

Based on timeline by Bruce Hamilton (http://yarchive.net/chem/tetraethyl_lead.html)

For many years automakers kept their distance from the oil industry, but in 1924, a corporate marriage between GM and Standard Oil Co. of New Jersey joined the two industries in a venture called Ethyl Corporation that would sell tetraethyl lead additives (TEL) for gasoline. From the start there were signs of trouble to come. Two years before, a chemistry professor named W. M. Clark had warned the Surgeon General of the U.S. of “a serious menace to public health” from the toxins emitted by TEL. The government had replied that it couldn't afford to investigate the threat, and asked Ethyl Corporation to submit the research they'd undertaken. Ethyl Corporation responded that no experiments had been performed. In early 1924, two GM employees died manufacturing TEL, and the lead chemist Thomas Midgley also became ill with lead poisoning. Sensing trouble, Ethyl Corporation asked the U.S. Bureau of Mines to investigate, but specified that their conclusions should not be made public.

All hell broke loose in October 1924 with the severe poisoning of 50 workers in a Standard Oil refinery in New Jersey just across the bay from New York City. When five of the workers suffered what was described as “violent insanity,” and died soon after, the news was carried on the front pages of papers around the country. Leaded gasoline was banned in dozens of cities and states and Kettering announced it would be taken off the market voluntarily.

As the controversy escalated, the directors of Ethyl Corporation told the media and the government that no alternatives existed. “So far as science knows at the present time,” Midgley said, “tetraethyl lead is the only material available which can bring about these [antiknock] results, which are of vital importance to the continued economic use by the general public of all automotive equipment, and unless a grave and inescapable hazard exists in the manufacture of tetraethyl lead, its abandonment cannot be justified.” Experts at Harvard University and elsewhere disagreed, insisting that leaded gasoline was dangerous and alternatives were available, yet the government allowed leaded gasoline to go back on the market in 1926. Over 100 persons had died, and thousands more would be poisoned until the oil industry found ways to improve TEL.

Was Ethyl Corporation at fault? If so, how would you compensate the victims? What do you think the courts decided?

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You Be the Judge! Answer Key

The Case of the Master and Fellow Servant

Judge Lemuel Shaw refused Farwell's claim. He ruled that the victim's agreement with the railroad, his wage of \$2 per day, included a kind of premium for dangerous work—otherwise the wage would be less. The judge also established the "fellow servant" rule that would hold in many cases for the next 60 years: that one employee could not sue the employer if the injury was the result of the negligence of a fellow employee. The result was to insulate employers from injury claims brought by their workers—a ruling that would be reversed by workers' compensation laws in the 1910s.

The Case of the Towering Inferno

The jury acquitted the owners of fault. Part of their reasoning was that the prosecution had failed to prove that the owners knew the exit doors were locked at the time in question. However, the owners lost a subsequent civil suit, and the families of the deceased won compensation in the amount of \$75 per victim.

The Case of the Deadly Gasoline

The victims of TEL poisoning were compensated by amounts ranging from \$500 to \$2,000. Ethyl Corporation was not penalized, and for the next 40 years, leaded gas remained essentially unregulated.

Burden of Responsibility: Present

LESSON 3.3

U.S. HISTORY OR U.S. GOVERNMENT

Time

50 minutes

Materials

Equipment

Computer with Internet access

Resources

- Selected OSHA Safeguards handout
- Teens at Work handout
- OSHA information for teen workers (<http://www.osha.gov/SLTC/teenworkers>)

Prior Student Learning

Students should have basic familiarity with U.S. history from 1950 to the present.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Explain the formation, operation, and accomplishments of the Occupational Safety and Health Administration (OSHA).
- Recognize how social attitudes influence public policy concerning the workplace and other aspects of public life.
- Identify the ways in which occupational-safety laws protect teenage employees.

Lesson Activities

Lesson Springboard

By the 1950s, most employees no longer feared losing a hand or a leg or becoming crippled or poisoned on the job. In the previous lesson we saw that workers' compensation not only reimbursed injured employees but also made the workplace far safer by raising the costs of accidents to employers. Union rules had a similar effect. In 1913, the death rate in mining was 329 per 100,000 workers whereas in 1960 it was about 40 per 100,000. Manufacturing jobs showed a similar trend. Safety also improved because the types of jobs that Americans held also changed. Farms and factories employed two-thirds of the labor force in 1940 but by 1970 a large majority of Americans worked in white-collar jobs. These trends convinced the experts that working would soon be safer than staying home—after all, it was already safer than driving a car.

Lesson Development

Direct Instruction

Were the experts right? Not exactly. Tell students that the experts of the 1950s were focusing on industrial accidents, such as the loss of a limb or an eye, but that times had changed. Changes in the modern workplace, along with higher social expectations about safety, brought about a new definition of workplace injuries.

First, many began to recognize that work causes not only accidents but also disease. Employees might break bones, or might lose a limb or an eye in a single, spectacular event, but it was far more likely that they would incur a long-term illness such as cancer or emphysema, or be poisoned by asbestos or lead toxins, or in cases of repetitive stress, suffer carpal tunnel syndrome and all manner of back or limb injuries. In fact, occupational disease consumes more healthcare resources than do occupational accidents, and will continue to do so in the future.

Burden of Responsibility: Present

LESSON 3.3

Second, for many people, conditions in today's workplace create an environment that leads to psychic disorders, such as stress, depression, and substance abuse. Since most job growth in the U.S. has occurred in service or white-collar work, it stands to reason that more "injuries" are psychological. Americans are working long hours under lots of pressure. Often they do not enjoy the benefits or job security they need to be psychologically secure. This is an area of controversy, however, because it's hard to measure psychological disorders. As a result, workers may find that the government and health insurers are reluctant to classify them as illnesses under the law.

Third, the social movements of the 1960s led to public policies and legislation that required businesses to be socially responsible. They also demanded that government prevent accidents from happening, not merely compensate the victims. In particular, the environmental movement called attention to the growing threat of "toxic" substances, such as asbestos and lead, and the inflammable materials prevalent in apparel and toys. "Anti-nuke" activists warned of chemical and nuclear wastes, and the consumer movement, led by Ralph Nader, added its voice to this chorus for reform. In 1970, Congress created the Occupational Safety and Health Administration (OSHA) to prevent work-related illnesses, injuries, and deaths. Its authority covers almost all nongovernmental workplaces in the U.S.

Class Discussion

Ask the class whether there exist occupational diseases that would not be classified as "accidents on the job." Can students think of recent diseases featured in the news? What obstacles might victims of "occupational diseases" face when they try to get compensation?

Ask students whether the workers' compensation programs they learned about in the previous lesson are likely to compensate victims of long-term accidents on the job.

Direct Instruction

Tell students that OSHA enforces laws through education, workplace inspections, fines and criminal penalties, and employee training. Its major accomplishments have been in fighting toxic chemicals, blood-borne pathogens, air and water pollution, unguarded machinery and ergonomic injuries on the job. (See the Selected OSHA Safeguards handout.) OSHA has also played a big part in reducing environmental noise, improving standards of food safety, and safeguarding workplaces against epidemics such as avian flu. The agency conducts thousands of inspections each year at workplaces ranging from construction sites and power plants to nursing homes and poultry farms. It collects statistics on workplace injuries in order to direct its inspection and enforcement efforts.

Class Exercise

Distribute the Teens at Work handout. Have students read the three scenarios where a teen is hurt on the job. Then have them consult the OSHA website for teen workers (<http://www.osha.gov/SLTC/teenworkers>). Did a

Burden of Responsibility: Present

LESSON 3.3

safety violation occur in any of these scenarios? Have students share any experiences of their own that resemble those on the handout, or any experiences in which they were injured or threatened with injury on the job.

Lesson Closure

For a full century after the Industrial Revolution, workplace safety was the responsibility of a hodgepodge of entities: employers, insurance firms, judges, unions, and state and local labor laws. With the establishment of OSHA in 1970, this began to change. Now employees are protected by a more uniform set of standards that are overseen by a single agency, backed by a regular cycle of inspections, and enforced by fairly consistent penalties.

Possible Prior Misconceptions

Students may not realize that occupational safety is protected by employer safety programs, federal and state labor laws, workers' compensation, and union contracts, as well as by OSHA.

Students may not understand that laws concerning teenage workers are different from those that concern adults. Wages, hours, and working conditions are specified for teenagers in every state.

Student Assessment Artifacts

None (but see "Variations and Extensions")

Variations and Extensions

Have students write one-paragraph evaluations of the scenarios in the Teens at Work handout. They may consult the OSHA website for more detailed rulings on workplace violations like the ones described in the handout or interview experts for their opinions.

Have students research the role of OSHA in regulating asbestos. The use of asbestos cost thousands of lives lost or injured, billions of dollars in corporate fines, and over a decade of dispute among government, business, unions, and political activists in the courts.

Burden of Responsibility: Present

LESSON 3.3

National and State Academic Standards

NATIONAL **NCSS Curriculum Standards for Social Studies**

VI. Power, Authority, and Governance

- c. analyze and explain ideas and mechanisms to meet needs and wants of citizens, regulate territory, manage conflict, establish order and security, and balance competing conceptions of a just society;

X. Civic Ideals and Practices

- d. analyze and evaluate the influence of various forms of citizen action on public policy;
- e. analyze a variety of public policies and issues from the perspective of formal and informal political actors;
- f. evaluate the effectiveness of public opinion in influencing and shaping public policy development and decision making;

CALIFORNIA **History-Social Science Content Standards**

Principles of American Democracy

- 12.7 Students analyze and compare the powers and procedures of the national, state, tribal, and local governments.
 - 12.7.5 Explain how public policy is formed, including the setting of the public agenda and implementation of it through regulations and executive orders.

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Selected OSHA Safeguards

The following are some of the changes in industrial safety regulation brought about by OSHA.

1. **Guards on all moving parts**—By 1970, there were guards to prevent inadvertent contact with most moving parts that were accessible in the normal course of operation. With OSHA, use of guards was expanded to cover essentially all parts where contact is possible.
2. **Permissible exposure limit**—Maximum concentrations of chemicals are stipulated by law for chemicals and dust. They cover only around 600 chemicals and most are based on research from the 1950s and 1960s.
3. **Personal protective equipment**—Respirators, gloves, coveralls, and other protective equipment are now used when handling hazardous chemicals; goggles, face shields, ear protection are standard in industrial environments.
4. **“Lockouts”**—In the 1980s, requirements were set for locking energy sources in an “off” condition when performing repairs or maintenance.
5. **Confined space**—In the 1990s, requirements were set for air sampling and use of a “buddy system” when working inside tanks, manholes, pits, bins, and similar enclosed areas.
6. **Hazard communication**—Also known as the “Right to Know” standard, this rule requires that the hazards of chemical products used in the workplace be clearly communicated to employees and the public.
7. **Process safety management**—These are rules that attempt to reduce large scale industrial accidents. Although enforcement by OSHA has been spotty, the rules have become widely accepted by the petrochemical industry.
8. **Bloodborne pathogens**—In 1990, OSHA issued a standard meant to prevent healthcare workers, and others, from exposure to bloodborne pathogens such as HIV and hepatitis B.
9. **Trenching and shoring**—OSHA rules specify that trenches and excavations where employees are working must be provided with safeguards against slumps and cave-ins.

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Teens at Work

Ben is a 15-year-old sophomore who works after school and on weekends as a clerk at a sporting goods store. Since his parents let him work only 2 hours on school nights, he tries to boost his income by working as much as possible on the weekends—usually 6 hours each day. Ben’s responsibilities include stocking heavy items such as free weights, exercise bikes, and outboard motors, which he does for several hours at a time. Last month he was diagnosed with lower-back strain and had to take a leave of absence from his job.

Safety Violations?

When school is in session, teens aren’t allowed to work more than 18 hours each week, more than 3 hours on a school day, or more than 8 hours on a weekend or holiday. It’s also likely that the sporting goods store violated rules on lifting heavy items. These are set state by state, and usually require frequent breaks for employees who lift items weighing more than 40 pounds.

Janice, a 17-year-old senior, was working the french fry station at a fast-food restaurant when she slipped on water leaking from an ice-making machine and instinctively put out her hand to break her fall. Unfortunately, her hand went into the deep fat fryer containing hot oil and she sustained severe burns to her left hand and forearm. The outlet was short-staffed on the day of accident and the manager was working at the registers instead of monitoring workplace safety. Although the company’s policy was that spills be mopped up, it was common practice to leave them at busy times, covered only with a sheet of cardboard. At those times, greater priority was given to serving customers than to cleaning up spills. The ice-maker had been leaking for several days, and various attempts had been made by different contractors to fix the leak. Nobody had sole responsibility to coordinate the repair of faulty equipment, and poor communication between different shift managers left the equipment leaking over a long period of time.

Safety Violations?

OSHA ruled that the accident was completely avoidable because the company had failed to maintain a safe system of work or to carry out a sufficient assessment of the risks associated with slipping within the kitchen. Failure to repair the ice-maker machine was an obvious violation, as was the manager’s lack of oversight. The company was fined \$40,000 and required to fix every violation.

Randy was 17 when he was hired as manager of a video arcade in San Jose, a job he’d looked forward to getting. The hours were good, the pay was fair, and he got to play the machines for free after hours or when he wasn’t with customers. However, the arcade was extremely noisy all day long. In spite of the sign the owners had posted, warning of the high noise level, Randy wore no ear plugs and suffered hearing loss after a year on the job.

Safety Violations?

Workplaces where sound levels are an average of 85 decibels or higher for more than 8 hours must have programs to save the hearing of workers and must provide free hearing-protection devices to them. Employees at video arcades, concert halls, construction sites, or doing work with lawnmowers, motorcycles, or machinery are at risk. The arcade violated the law and was heavily fined, since a warning sign is no substitute for compliance.

Workplace Injury Presentation

LESSON 3.4

ENGLISH LANGUAGE ARTS

Time

Research: 150 minutes

Presentations: 100 minutes

Materials

Equipment

Access to computer lab

Resources

- Workplace Injuries Presentation handout
- Sample Grading Rubric

Prior Student Learning

Students should have completed all prior lessons in this unit.

Essential Question for This Unit

How can workplace injuries be reduced, and who should be responsible for implementing reduction strategies?

Objectives

After completing this lesson, students should be able to

- Synthesize the information and learning in the unit into a 15–20 minute presentation.
- Use PowerPoint slides, a written brochure, and oral presentation to communicate about workplace injuries effectively.

Lesson Activities

Lesson Springboard

Students have learned about workplace injuries from a variety of perspectives in this unit, ranging from an investigation of legal rights to biomedical explanations of physical injuries and their treatments. Now students will have a chance to synthesize their knowledge into a cohesive presentation about the incidence and prevention of workplace injuries in a specific industry.

Lesson Development

Project Introduction

Introduce the culminating event for the unit, a 15- to 20-minute presentation of common workplace injuries for an industry or company, prevention strategies and treatment options for these injuries, workers' rights and employer obligations, and background statistics. Give students the Workplace Injuries Presentation handout and explain all the requirements and the group members' roles. Choose an appropriate due date and announce the day or days that are reserved for the class to use the computer lab.

Clarify the difference between the informational brochure and the safety manual. The brochure is what an employee will walk away with after the presentation. It should summarize the key points about prevention, symptoms of the injury, and resources when an injury occurs. The safety manual should include all of the information from the presentation in an organized manner; it would be used as a reference by any employee who wanted detailed information.

Make sure groups understand that they should answer the essential unit question for their specific company somewhere in their presentation. All the information presented about the workplace injuries should support their conclusions about the responsibilities employers, employees, and government agencies have in reducing injury rates.

Workplace Injury Presentation

LESSON 3.4

Assign or allow students to form groups, and give them the rest of the period to choose a company or industry and discuss their plan for completing the project. Teachers often find it useful to hand out the grading rubric now and answer any clarifying questions about what is expected of each group. A sample rubric is provided for teacher reference. You may wish to expand the rubric to include specification of what content should be included. During the research and preparation period of this project, ask groups to reference the rubric and evaluate their progress.

Research for the Project

Collaborate with the math instructor so that time in math class can be devoted to researching and creating the statistical graphs that will be part of the written and oral presentation. The math instructor can aid in interpreting the statistics and guide students to the most appropriate websites and other sources of data.

Remind students that they can and should use all of their teachers as resources when creating the presentation. All the knowledge and skills needed to be successful have already been introduced during the unit; it is the group's job to apply that learning to a specific industry or company. The following lessons are particularly relevant:

- Researching applicable laws, summarizing government documents, and making a brochure was practiced in English class (Lessons 2.2 and 2.4)
- Gathering relevant statistics and presenting them in an accessible way was practiced in Algebra class (Lessons 2.1 and 2.3)
- The physiological basis of common injuries, prevention strategies, and treatment options was covered in Biology, Physics, and Health Science classes (Lessons 1.1–1.4 and 2.5)

Encourage students to find out the injury rates of the specific company they chose instead of stopping their research at the injury rates of the entire industry. Finding these statistics may be time-consuming and involve calling government agencies or the company itself for information, but that is what real researchers and reporters do. Students should not restrict themselves to convenient Internet searches.

Presentations

Choose a method of holding the class accountable for listening closely to each presentation. Some classes like to have students evaluate the presentations using the same rubric as the teacher. These peer evaluations then become part of the final grade for the project or a basis for class discussion if the teacher chooses not to use peer evaluations as part of student grades. Other instructors give a quiz on the important information from the presentations or require students to turn in notes or a reflection at the end of the period.

Workplace Injury Presentation

LESSON 3.4

Lesson Closure

When the presentations are concluded, it is a good time for students to reflect on all the work they have accomplished and knowledge they have gained throughout the unit. It is also a good opportunity for the class to give feedback on what they would change about the unit for next year. Have students write a brief evaluation of the unit, what they thought was effective and ineffective about the lessons, and the knowledge they are taking away from the experience. Make sure that students make explicit connections between what they did in class and possible career applications, as well as communicate an understanding of how academic disciplines interact when real-world situations must be analyzed.

Possible Prior Misconceptions

None

Student Assessment Artifacts

Group PowerPoint presentation
Workplace Injuries brochure
Safety manual

Variations and Extensions

Take a field trip to a large production plant to visit its safety department.

Invite a panel of human resources, occupational health and safety, and occupational rehabilitation experts to evaluate the presentations and give feedback.

Create an evening event and invite parents and community leaders to watch and evaluate the presentations.

Workplace Injury Presentation

LESSON 3.4

National and State Academic Standards

NATIONAL

NCTE Standards for the English Language Arts

1. Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).
4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.
7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
8. Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
12. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

CALIFORNIA

English Language Arts Content Standards

Reading

- 2.3 Generate relevant questions about readings on issues that can be researched.
- 2.4 Synthesize the content from several sources or works by a single author dealing with a single issue; paraphrase the ideas and connect them to other sources and related topics to demonstrate comprehension.
- 2.5 Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration.

Writing

- 1.1 Establish a controlling impression or coherent thesis that conveys a clear and distinctive perspective on the subject and maintain a consistent tone and focus throughout the piece of writing.
- 1.2 Use precise language, action verbs, sensory details, appropriate modifiers, and the active rather than the passive voice.
- 1.3 Use clear research questions and suitable research methods (e.g., library, electronic media, personal interview) to elicit and present evidence from primary and secondary sources.
- 1.4 Develop the main ideas within the body of the composition through supporting evidence (e.g., scenarios, commonly held beliefs, hypotheses, definitions).
- 1.5 Synthesize information from multiple sources and identify complexities and discrepancies in the information and the different perspectives found in each medium (e.g., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents).
- 1.6 Integrate quotations and citations into a written text while maintaining the flow of ideas.
- 1.7 Use appropriate conventions for documentation in the text, notes, and bibliographies by adhering to those in style manuals (e.g., *Modern Language Association Handbook*, *The Chicago Manual of Style*).
- 1.8 Design and publish documents by using advanced publishing software and graphic programs.
- 1.9 Revise writing to improve the logic and coherence of the organization and controlling perspective, the precision of word choice, and the tone by taking into consideration the audience, purpose, and formality of the context.
- 2.3 Write expository compositions, including analytical essays and research reports:
 - a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.

Name _____ Date _____ Period _____

Workplace Injuries Presentation

Essential Question: How can work related injuries be reduced, and who should be responsible for implementing reduction strategies?

Your group is the Human Resources department of a company, and must prepare a presentation on common workplace injuries that will be given to all employees. You enlist the help of experts to explain different aspects of workplace injuries during the presentation, and try to make it as engaging and informative as possible.

Presentation Requirements:

- Total Length: 15–20 minutes
- PowerPoint presentation
- Must include spoken contributions from a legal professional, a medical expert/rehabilitation specialist, a member of the company's safety team, and a government or company statistician
- At least three common workplace injuries that occur in your industry
- Informational brochure that summarizes key points of the presentation
- Safety manual that includes all of the information in the presentation
- *Answer the essential question relative to the company or industry your group has chosen*

Your group can choose to include:

- A brief skit, testimonials from injured workers, or other dramatic elements
- Question-and-answer session with the class (only if presentation is already 15 minutes long)
- History of government regulation of your industry or type of injury

Write down the following information and hand it in to the teacher before your presentation:

Group Members

Company/Industry

Common Workplace Injuries for this Industry (name at least three)

Name _____ Date _____ Period _____

Workplace Injuries Presentation

Group Members: _____

Company/Industry: _____

Common Workplace Injuries for this Industry (name at least three): _____

| Role | Group Member Responsible for this Role | Contribution to the Presentation | Class/Discipline (who to ask for help) |
|---|--|--|--|
| Human Resources Representative | | Team leader: makes sure the presentation is organized and complete, introduces and concludes by answering the essential question during the presentation, responsible for the informational brochure and PowerPoint slides | English |
| Medical Expert/ Rehabilitation Specialist Occupation: | | Explains the anatomy and physiology involved in the types of injuries common in the industry; explains treatments and follow-up care; contributes to safety manual and PowerPoint slides | Health Science, Biology, Physics |
| Safety Team Member | | Explains main causes of common injuries and how to prevent those injuries in the workplace, responsible for safety manual and contributes to PowerPoint slides | Health Science, Physics |
| Legal Expert | | Explains the OSHA requirements that pertain to the injuries, tells employees what rights they have and what obligations the company has, contributes to safety manual and PowerPoint slides | English, U.S. History or U.S. Government |
| Statistician | | Presents charts and graphs communicating the injury rate of the industry/company, lost productivity due to injury, etc., contributes to safety manual and PowerPoint slides | Math |
| Injured Worker (optional) | | Gives firsthand account of the injury, contributes to safety manual and PowerPoint slides | Health Science, Biology |

Name _____ Date _____ Period _____

Sample Rubric

Final Group Presentation: Workplace Injuries

Group Members: _____

Company/Industry: _____

| CATEGORY | 4 | 3 | 2 | 1 |
|---|--|---|---|--|
| Content | Members show full understanding of each topic in the presentation. Thorough research is clearly demonstrated about three or more injuries. Group adds optional content to the presentation. Answers the essential question with full supporting evidence and a thoughtful, reasoned explanation. | Members show a good understanding of each topic in the presentation. Research is good about three common injuries but misses one or two important points. Answers the essential question with a reasoned explanation. | Members show a good understanding of some of the topics. Research misses some key points but covers two or three injuries. It is clear that available resources were not fully used. Group does not attempt to add optional content. Answers the essential question. | Members do not seem to understand the topics very well. Research is lacking or absent. One or two injuries are addressed. Does not answer the essential question. |
| Preparedness | Group is completely prepared and has obviously rehearsed. | Group seems pretty prepared but might have needed a couple more rehearsals. | Group is somewhat prepared, but it is clear that rehearsal was lacking. | Group does not seem at all prepared to present. |
| Oral and PowerPoint Presentation | Group looks relaxed and confident. Establishes eye contact with everyone in the room during the presentation. Each member speaks clearly and transitions between speakers are smooth. PowerPoint slides use color and images effectively and emphasize key points well. | Group establishes eye contact with everyone in the room during the presentation. Most members speak clearly, and transitions between speakers are often smooth. PowerPoint slides repeat what is said in presentation. | Group sometimes establishes eye contact. Members mumble and/or make a presentation that is sometimes hard to follow. Transitions between speakers are abrupt. PowerPoint slides are informative but are sometimes disorganized or distract from overall presentation. | Group slouches, moves or plays around, or does not look at people during the presentation. Members do not communicate their ideas clearly, and there are no transitions between speakers. PowerPoint slides add little or nothing to the presentation or are disorganized and unrelated to the presentation. |
| Brochure | Brochure layout is well-organized and effective; uses color. Graphs, photographs, and/or images are used to emphasize ideas and add interest. Brochure summarizes what an employee needs to know about workplace injuries concisely without missing any key points. It is easy to understand. | Brochure has organized layout and includes color. Graphs and images are included. Summary includes all key points and can be well understood by an employee. Contains a few grammatical and spelling errors. | Layout of brochure makes finding information difficult. Color, graphs, and images may be present but do not effectively emphasize content. Summary misses one or two key points. Contains several grammatical and spelling errors. | Sloppy brochure that is disorganized and does not use color or images effectively. Summary lacks several key points and would not be useful to an employee of the company. Contains many grammatical and spelling errors. |
| Safety Manual | Well-organized manual that includes all information from the presentation. Cover page, table of contents, graphs, and images included. Perfect grammar and spelling. Easily used as a reference by an employee of the company. | Includes all information from the presentation, with cover page, table of contents, graphs, and images. Can be used by employee as reference, though information might be hard to find. Contains a few grammatical and spelling errors. | Includes most of the information from the presentation. Disorganized and not written clearly, making information hard to find. Contains several grammatical and spelling errors. An employee would find using the manual difficult. | Includes some information from the presentation. Lacks organization and graphs and images are missing. Contains many grammatical and spelling errors. An employee would find the manual frustrating and not useful. |