

Lesson 13: Environmental Hazards and Human Health

Environmental Science

Day 1 Bell Ringer

What types of obstacles might people face that are in need of medical help?





Lesson 13.1

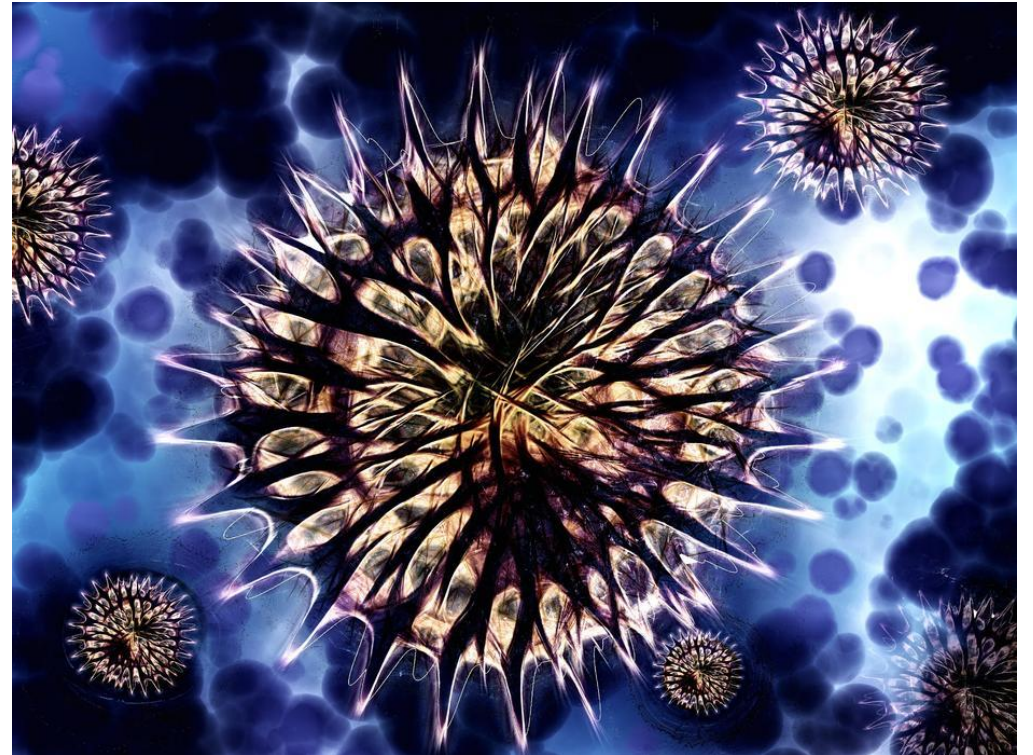
What Are the Major Types of Health Hazards?

What you will learn...

- The type of risks people encounter
- How to compare the process of risk assessment and risk management

Key Terms

- risk
- risk assessment
- risk management
- pathogen



Society Faces Many Types of Hazards

- **Hazards to human health result from a variety of environmental factors as well as the choices people make.**
 - **A risk is the probability of suffering harm from a hazard**
 - **can lead to injury, economic loss, damage, disease, or death**
 - **thought of as the probability to do harm**
 - **probability of developing lung cancer is 1 in 250 when smoking 1 pack per day**
 - **can also be described using a percentage**



Risk Assessment and Management

- Risk **Assessment**
 - Statistical method used to determine the amount of harm a behavior might cause to human health or the environment
- Risk **Management**
 - Decisions made about how to reduce a certain risk level and at what cost



Risk Assessment and Management {cont'd.}

- No one can live life completely risk-free, but it is very possible to reduce exposure to them.
- Understanding how serious the risks are and whether the benefits outweigh them is key.

VIDEO: Hazard and Risk -- What's the difference?

Five Major Hazard Types

- Biological Hazards
 - **Pathogens**
 - microorganisms, viruses, other disease-causing agents
- Chemical Hazards
 - From chemicals found in food, air, soil, water, and human-made products
- **Natural** Hazards
 - Fire, earthquakes, floods, severe storms, volcanic eruptions
- Cultural Hazards
 - Include unsafe work conditions, risks of criminal assault, poverty
- Lifestyle Hazards
 - Smoking, poor diet choices, drug use, etc...

Risk Assessment

vs.

Risk Management

- **Hazard Identification:** What is the hazard?
- **Probability of Risk:** How likely is the event?
- **Consequences of Risk:** What is the likely damage?

- **Comparative Risk Analysis:** How does it compare with other risks?
- **Risk Reduction:** How much should it be reduced?
- **Risk Reduction Strategy:** How will the risk be reduced?
- **Financial Commitment:** How much money should be spent?

Day 1 Exit Ticket

What do scientists calculate in order to make a statement about a given risk?





Day 2 Bell Ringer

What are the five major types of hazards?

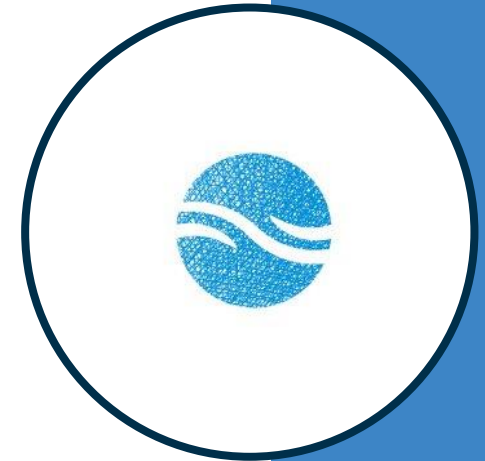


Lesson 13.2

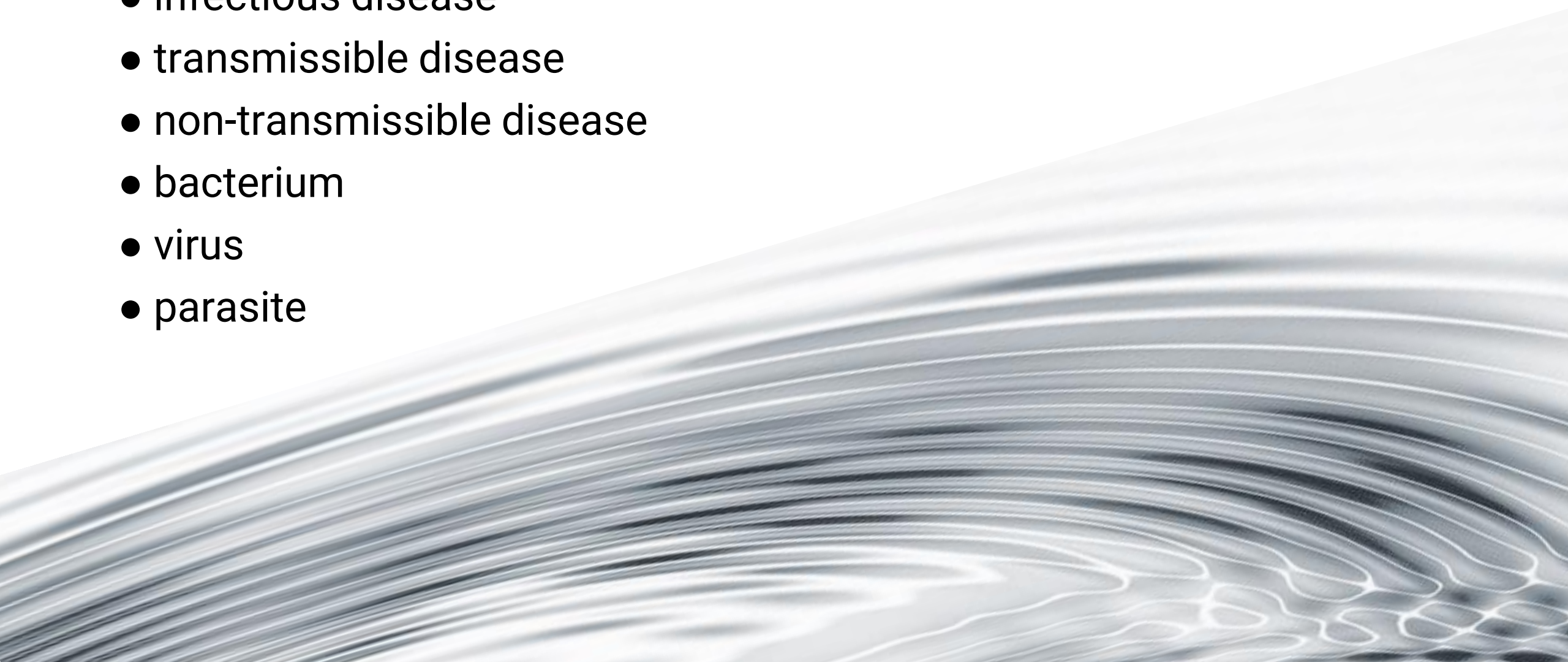
How do Biological Hazards Threaten Human Health?

What you will learn....

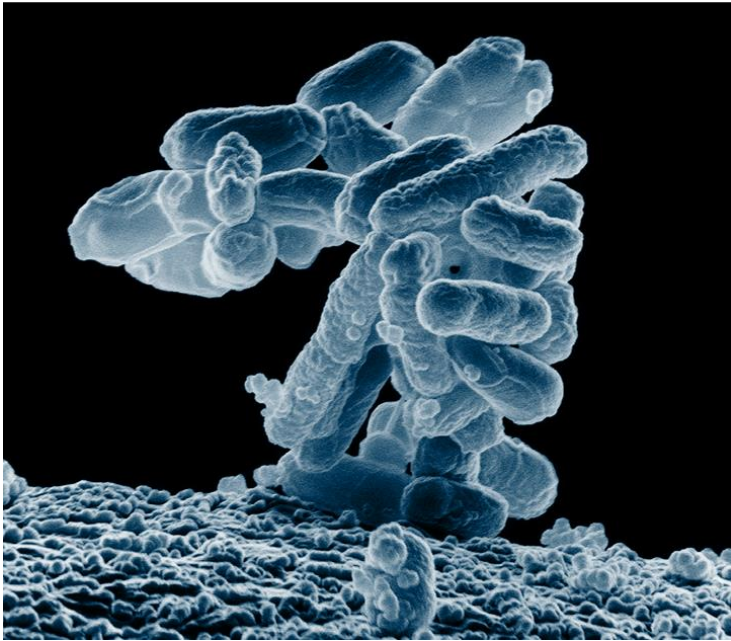
- Identify infectious diseases caused by pathogens and explain the differences between transmissible and non-transmissible diseases
- Explain the differences between bacteria and viruses, how they are spread and treated, and the role of parasites in disease
- Understand how to prevent or reduce the spread of diseases



Key Terms

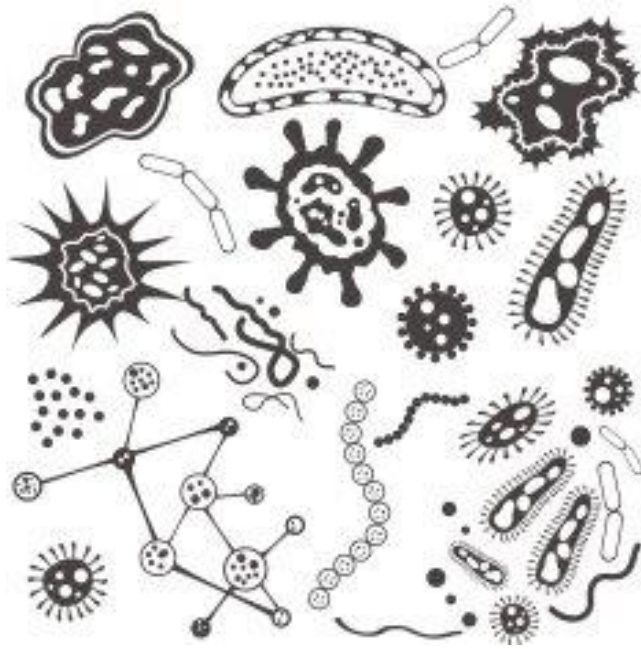
- infectious disease
 - transmissible disease
 - non-transmissible disease
 - bacterium
 - virus
 - parasite
- 
- A decorative graphic in the bottom right corner of the slide, consisting of concentric, overlapping ripples in shades of gray and white, resembling water or a stone dropped into a pond. The ripples are curved and flow from the bottom right towards the center of the slide.

Some Diseases Can Spread From Person to Person



- **Infectious diseases** are one of the most serious biological hazards people face.
 - Infectious Diseases are caused by a pathogen that invades the body and multiplies inside cells/tissues.
 - Include Bacteria, Viruses, Parasites

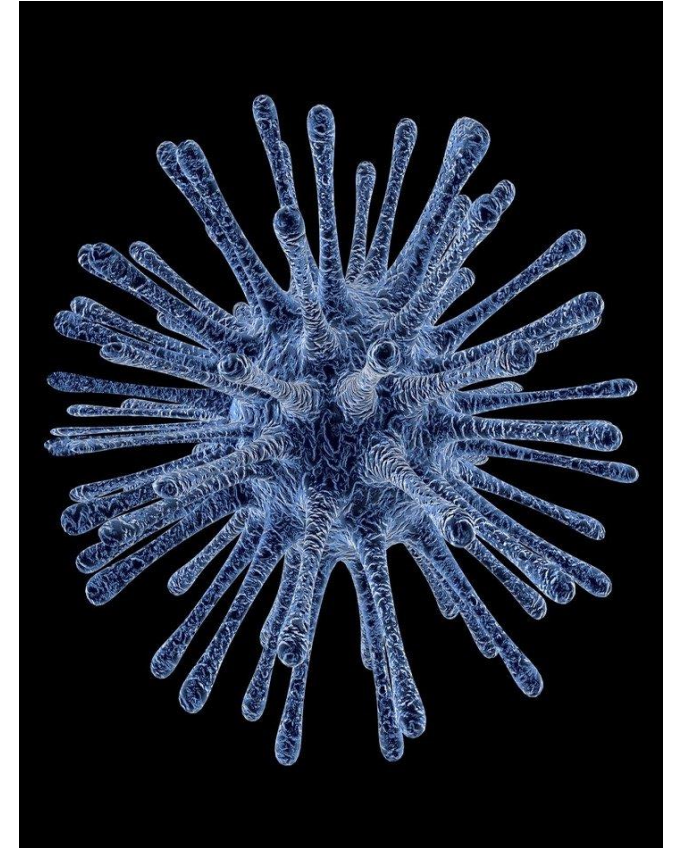
Bacteria



- single-cell organisms found everywhere
- multiply rapidly
- most are harmless
- some are beneficial
- some cause diseases
 - examples: strep throat, tuberculosis

Viruses

- **Smaller** than bacteria
- Work by invading a cell
- Takes over a cell's genetic machinery and copies itself
- Spreads through the body
- May cause disease
 - Examples: Flu, AIDS

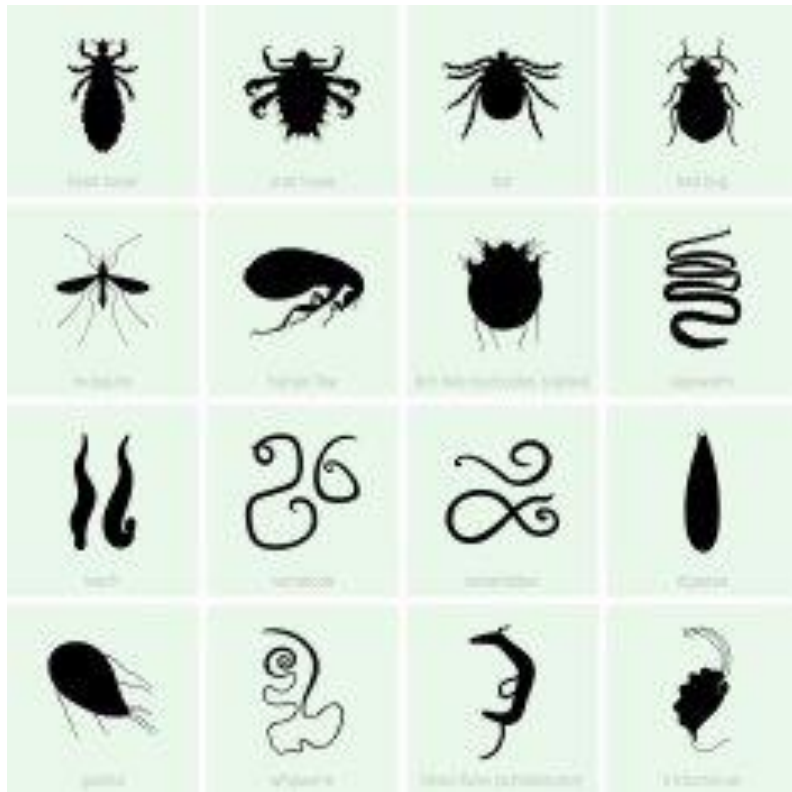


Parasites

- Organisms that live on or in other organisms and feed on them
 - Organisms that parasites feed on are hosts.
- Can cause infectious diseases
 - Examples: Malaria, Toxoplasmosis, Lice



Parasites {cont'd.}



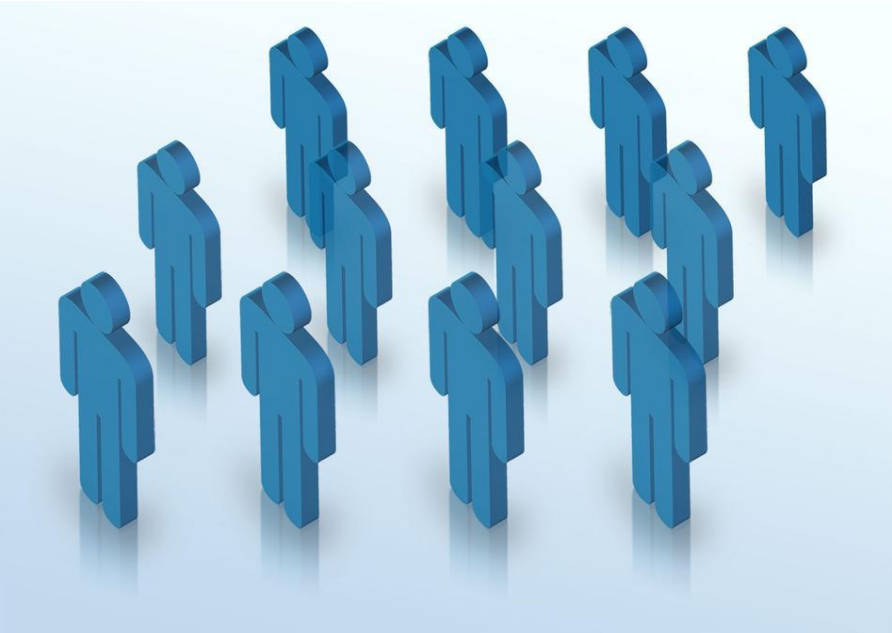
VIDEO:

How parasites change their
host's behavior

Transmissible Diseases

- **Infectious diseases** that can be passed on from one individual to another
 - may be bacterial
 - ear infections, tuberculosis, gonorrhea, etc...
 - may be viral
 - Covid-19, common cold, flu, AIDS, etc...
- Can be spread through the air, water, and bodily fluids

Non-Transmissible Diseases



- Caused by something other than a living organism
- Does not **spread** from person to person
 - Asthma, cardiovascular diseases, diabetes, most cancers, etc...

Day 2 Exit Ticket

What types of biological hazards does society face?



Day 3 Bell Ringer

What is the difference between a pandemic and an epidemic?



Tuberculosis

- **Tuberculosis (TB)** is a highly-contagious bacterial infection
 - destroys lung tissue
 - can lead to death
 - infect about 9 million people per year and leads to about 1.5 million yearly deaths
 - usually in underdeveloped countries
 - symptoms include a chronic cough
 - many strains are genetically-resistant to antibiotics
 - some people do not show symptoms

Tuberculosis {cont'd.}

VIDEO:

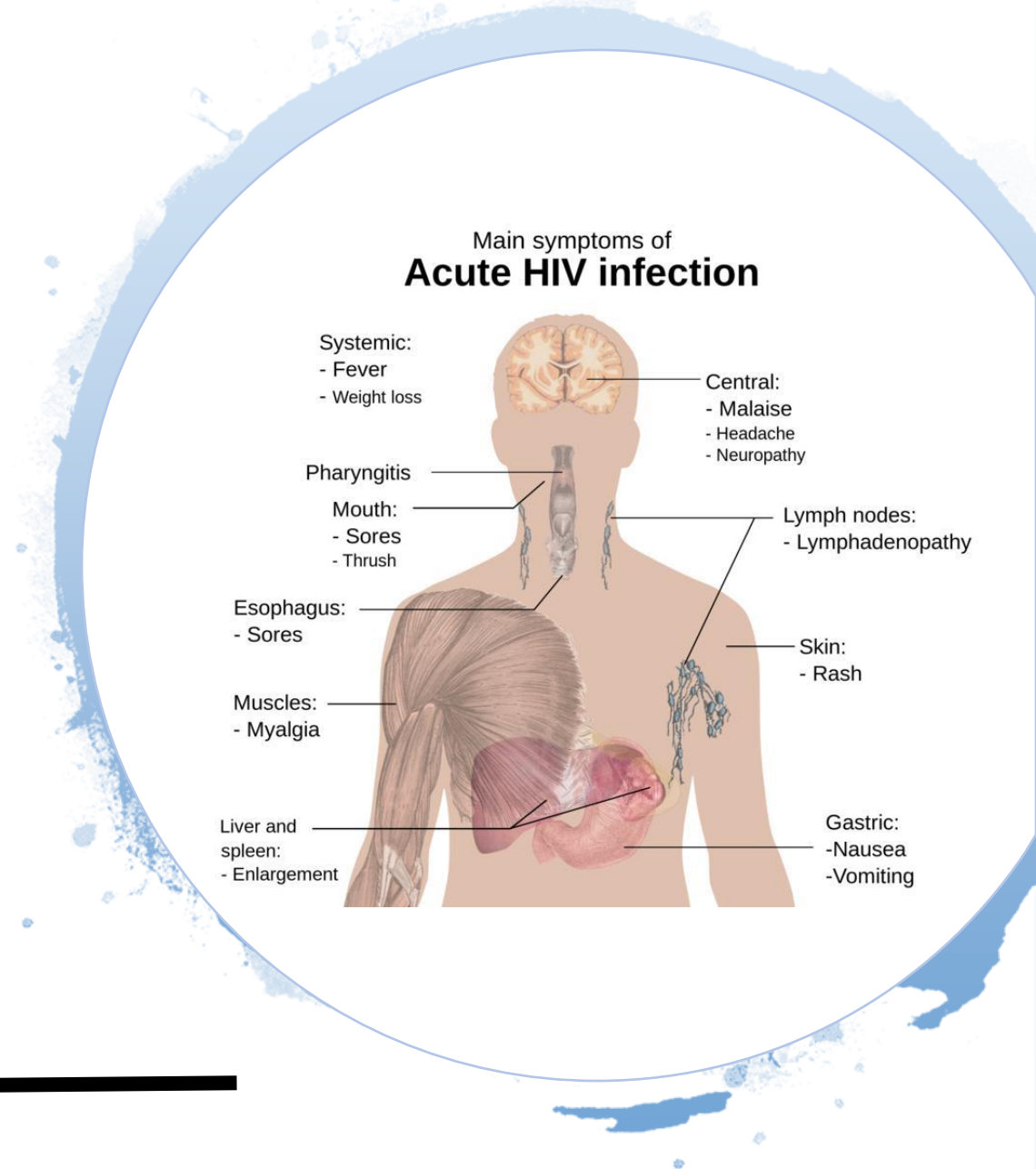
What makes tuberculosis (TB) the world's most infectious killer?

Viruses and Parasites Can Be Deadly

- Viruses cannot be cured by **antibiotics** and can lead to severe illness and/or death.
 - 1st largest killer = ~~influenza~~-COVID-19 (2020)
 - **airborne**, spreads easily, can lead to a pandemic
 - flu vaccines
 - 2nd largest killer =
 - virus that causes AIDS
 - transmitted through unsafe sex and exposure through blood often due to infected needles
 - 3rd largest killer = HBV
 - Hepatitis B Virus
 - damages the liver

HIV/AIDS

- first identified in 1981
- major threat to human health
- infection rate has declined
- impairs the immune system
- HIV can develop into AIDS
- AIDS is life-threatening
- treatment includes antiviral drugs that can slow its spread



HIV/AIDS {cont'd.}

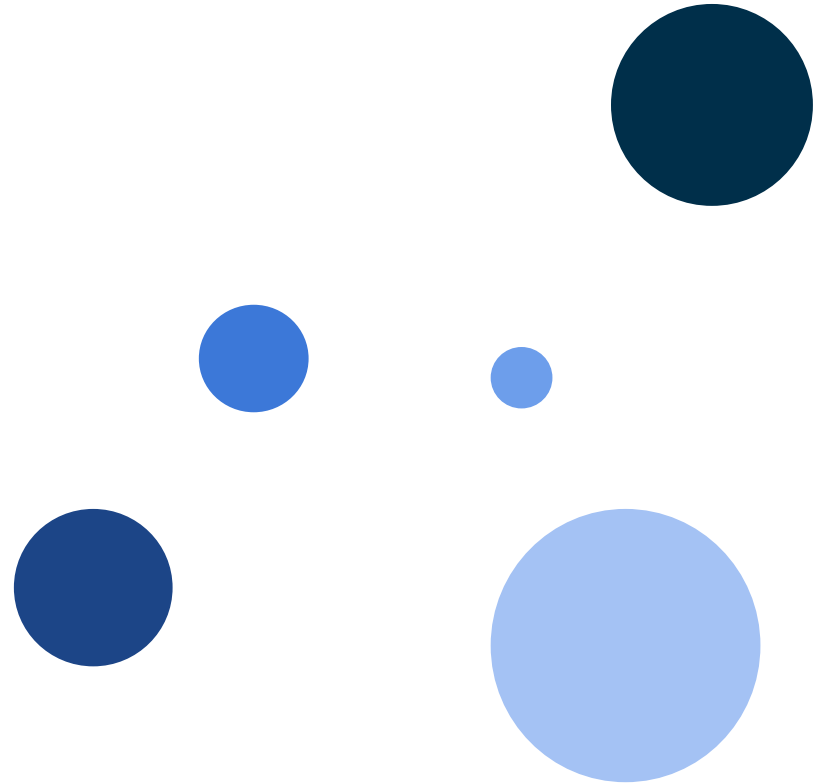
- More than **38 million** people died of AIDS-related diseases between 1981 and 2014.
- Worldwide, it remains that largest killer of people in the 15-49 age group.
- Has had a serious impact in sub-Saharan Africa
 - Has reduced the life expectancy there from 62 to 47 years of age
 - In Botswana, HIV has led to premature deaths
 - This has affected the country in numerous ways.



HIV/AIDS {cont'd.}

VIDEO:

HIV & AIDS - signs,
symptoms, transmission,
causes & pathology



Malaria

- Almost half of the world's population is at risk of getting malaria.
 - Most are in poor African countries
- No vaccine can prevent it
- Caused by a parasite and spread through mosquitoes
- It destroys a person's red blood cells
- Symptoms include chills, vomiting, severe abdominal pain, drenching sweats, headaches, and susceptibility to other diseases

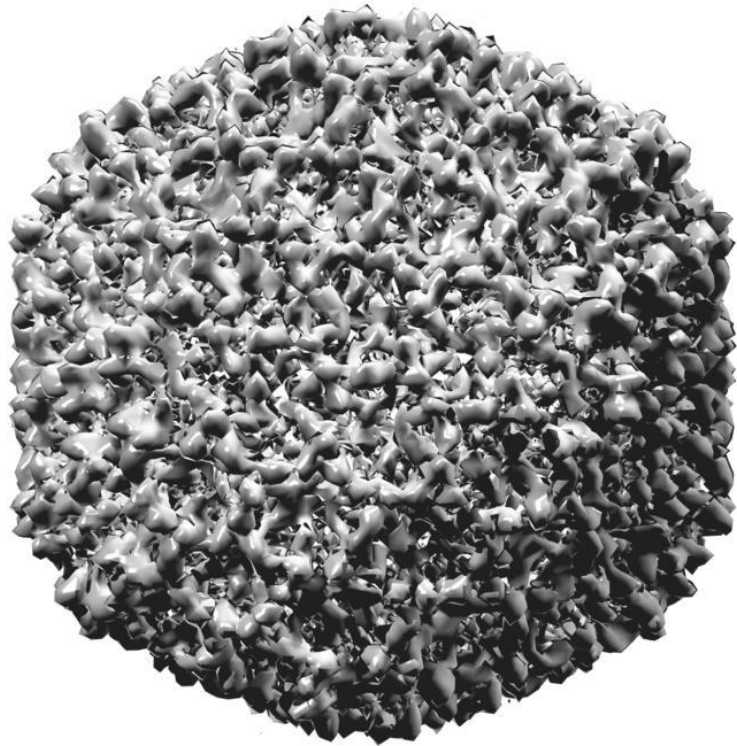


Malaria {cont'd.}



- More than 90% of cases occur in sub-Saharan Africa
- Most cases are in children five and under
 - Many who survive suffer brain damage/impaired learning abilities
- Malaria killed about 438,000 people in 2014.
 - Numbers might be higher, but there is a lack of healthcare and information

Society and Reducing the Incidence of Infectious Diseases



- Deaths from infectious diseases has dropped worldwide in recent years
 - From 35% to 16% between 1970 and 2015
 - more children have been **immunized**
 - better health measures have helped prevent/reduce diseases

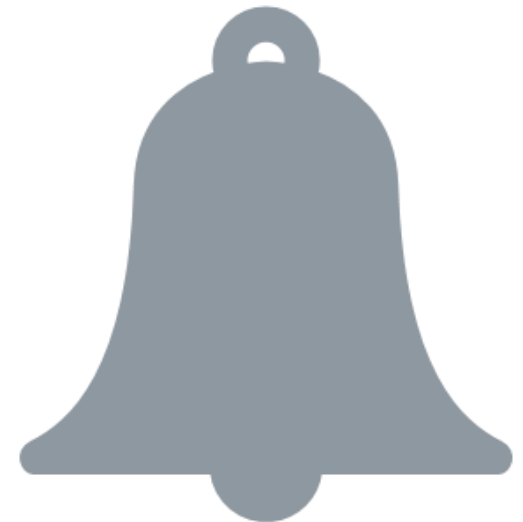
Day 3 Exit Ticket

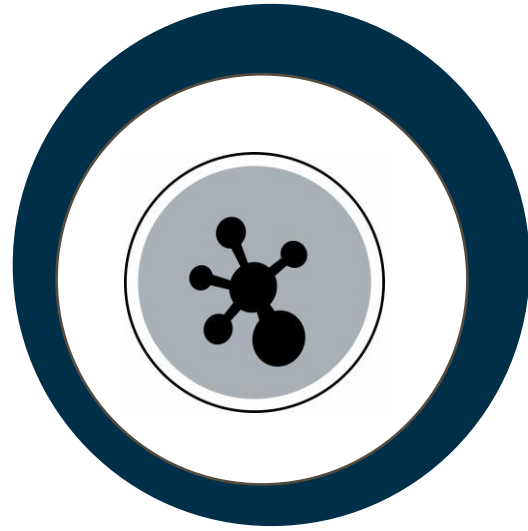
What virus kills the most people globally?



Day 4 Bell Ringer

What types of biological hazards does society face?





Lesson 13.3

How Do Chemical Hazards Threaten Human Health?

What you will learn....

- How chemicals in the environment can harm the human body
- How effects of toxic chemicals can be reduced or avoided

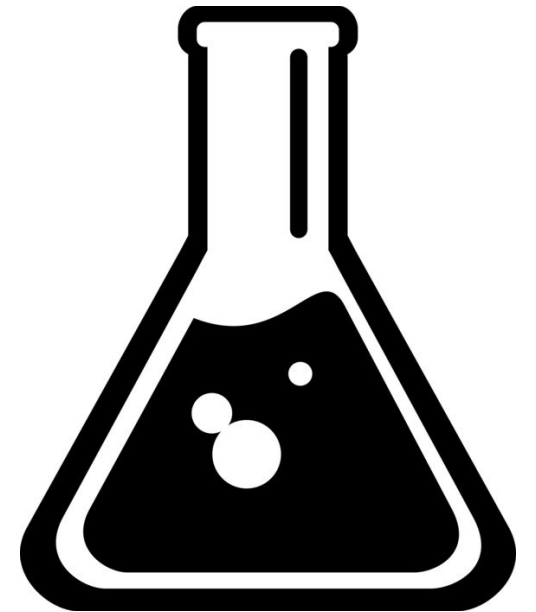
Key Terms

- toxic chemical
- carcinogen
- mutagen
- teratogen



Chemicals May Cause Cancers, Mutations, and Birth Defects

- Toxic chemicals can cause temporary or permanent effects to humans
 - element or compound
 - may cause cancers
 - may cause birth defects
 - can disrupt human endocrine, nervous, and immune systems
 - EPA has identified five that are most harmful



Carcinogens

- Chemicals, some types of radiation, certain viruses that cause/promote cancer.
 - can cause tumors
 - examples include: radon, arsenic, UV radiation, chemicals in tobacco smoke and others



Mutagens

- Chemicals or forms of radiation that cause an increase in the frequency of **DNA changes**
 - some cause no harm
 - others lead to cancer



Teratogens

- Chemicals that harm a fetus or embryo, or cause birth defects
 - Ethyl alcohol (ingredient in alcoholic beverages)
 - Women who drink alcoholic beverages while pregnant increase their risk of having babies with low birth weights
 - Leads to other physical, behavioral, developmental, and other health complications
 - Other teratogens include PCP, benzene, formaldehyde, vinyl chloride, lead, mercury, PCBs

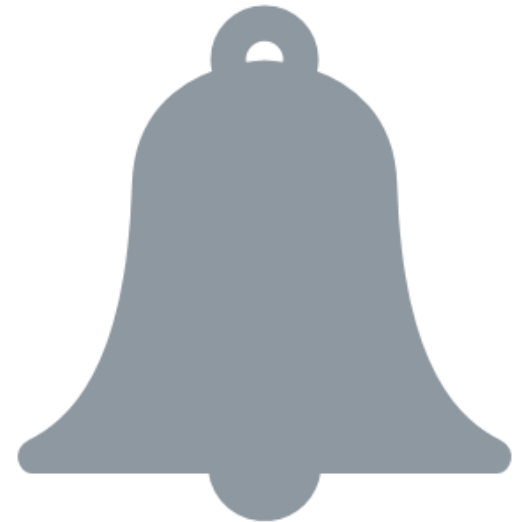
Day 4 Exit Ticket

What are the harmful effects of carcinogens?



Day 5 Bell Ringer

What is the main reason for a large drop in deaths due to infectious diseases since 1970?



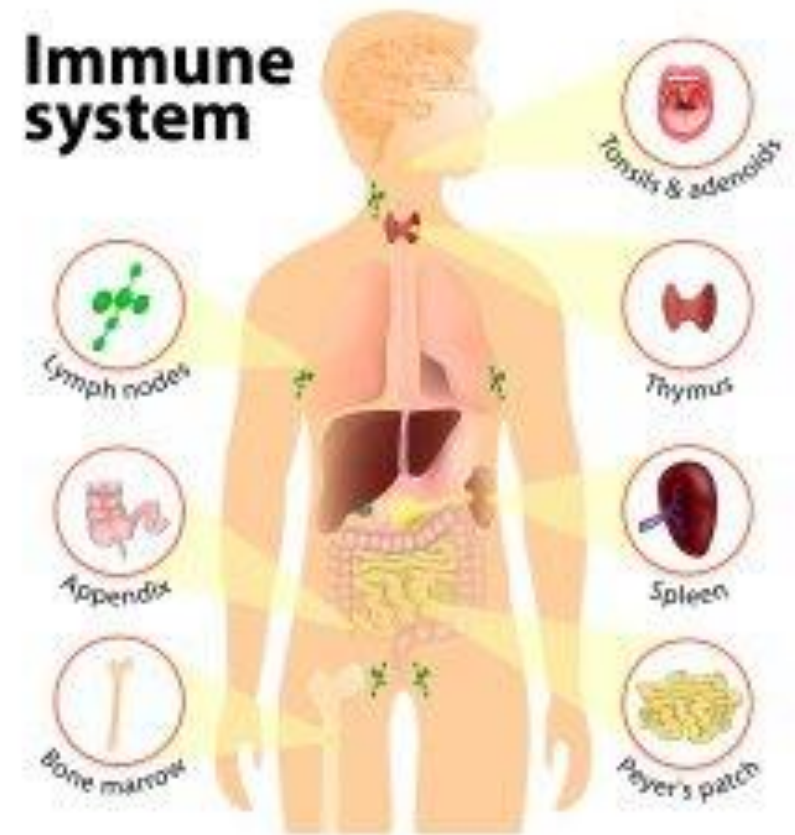
Some Chemicals Affect Body Systems



- Long-term exposure to some chemicals can lead to negative effects on various body systems
 - immune system
 - nervous system
 - endocrine system

Immune System

- **specialized cells** and tissues that protect the body against disease
 - forms antibodies to detect and destroy harmful invasive agents
 - chemicals like arsenic and methylmercury can weaken the immune system
 - body becomes vulnerable to attacks





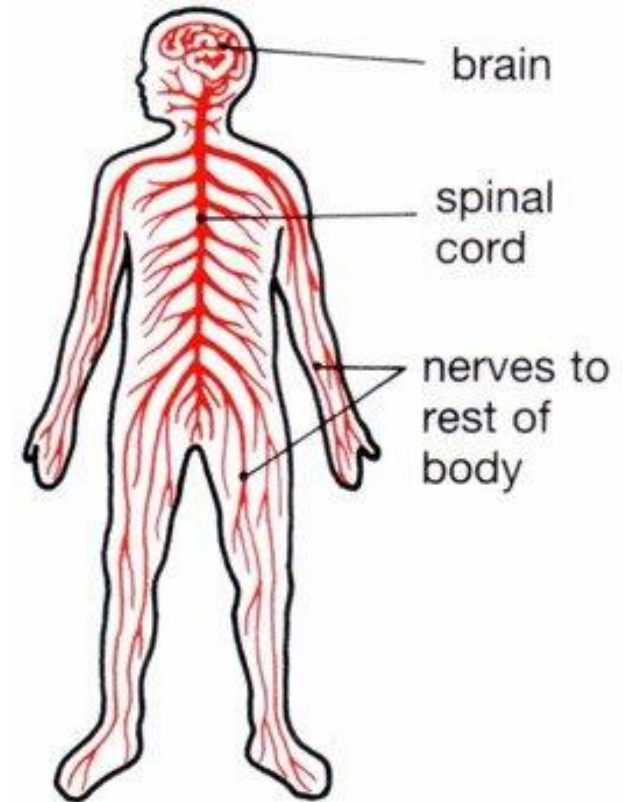
Immune System {cont'd.}

VIDEO:

How does your
immune system
work?

Nervous System

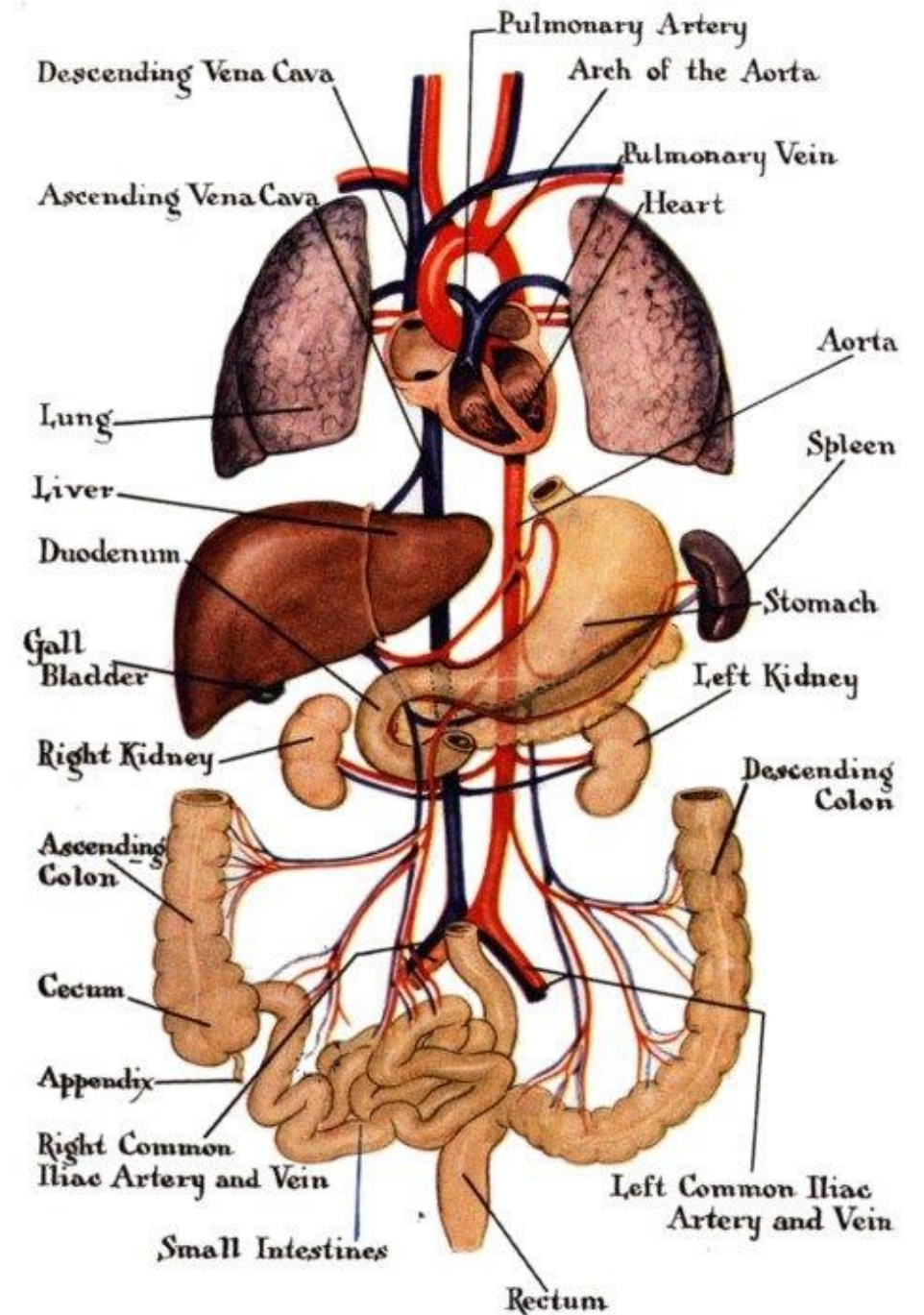
- **Neurotoxins** harm the nervous system
 - brain, spinal cord, peripheral nerves
 - can lead to behavioral changes, learning disabilities, ADD, paralysis, death
 - Examples include PCBs, arsenic, lead, certain pesticides



Endocrine System

- Uses hormones to regulate growth, development, sexual reproduction, learning ability, and behavior
 - Hormones have unique molecular structures that allow it to attach to cell receptors, send a chemical signal, and the cell then responds in a certain way.
 - Synthetic hormones can interfere
 - Known as HAAs (Hormonally Active Agents)
 - some herbicides and pesticides, lead, mercury, phthalates, some fire retardants, BPA
 - in some toiletries, cosmetics, detergents, baby powders, sunscreens, drug coatings, soft plastic products

Endocrine System {cont'd.}



Day 5 Exit Ticket

How can you reduce your exposure to BPA?



Day 6 Bell Ringer

How can toxic chemicals affect human immune, nervous, and endocrine systems?






Lesson 13.4

How Can People Evaluate Risks from
Chemical Hazards?

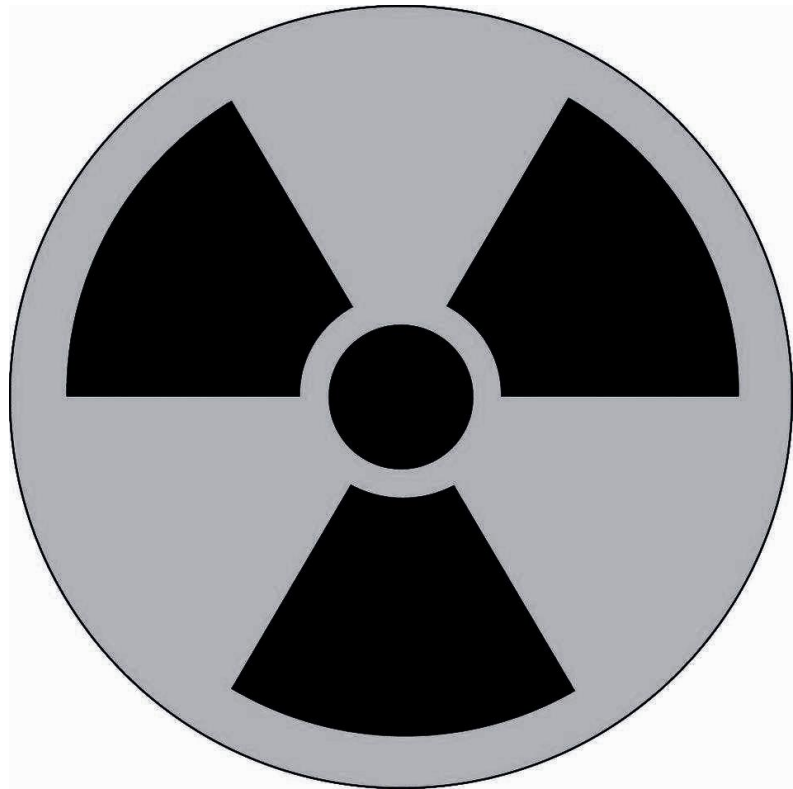
What you will learn....

- How scientists determine and measure toxicity
- Understand the potential threat of trace chemicals and the controversy surrounding their regulation
- Explain the precautionary principle, response, toxicity, and toxicology

Key Terms

- toxicology
 - response
 - precautionary principle
 - toxicity
 - dose
- 

Many Factors Determine Chemical Toxicity



- **Toxicology** = study of the harmful effects of chemicals on humans and other organisms
- **Toxicity** = measure of the ability of a substance to cause injury, illness, or death to a living organism
 - any synthetic or natural chemical is potentially hazardous if ingested or inhaled long enough or in a large enough dose



Toxicology

VIDEO: Toxicology

Estimating Toxicity

- Determining toxicity levels is often done through the use of live laboratory animals.
 - Rats and mice are most commonly used because their systems function in ways similar to that of humans
- Response is the health damage associated with exposure to a chemical.

Trace Levels of Toxic Chemicals

- Almost everyone that lives in a well-developed country is exposed to chemicals that may be harmful.
 - Many trace chemicals **build up** in the bloodstream.
 - **BPA** and arsenic are particularly harmful, but data about the effects regarding exposure to small amounts is unknown.

Society and the Precautionary Principle

- **Precautionary principle** is in effect when there is substantial preliminary evidence that technology, an activity, or chemical is harmful.
 - May affect the environment, one's health, or both
 - Decision makers take measures to prevent harm.
 - Deciding when/how far to go in applying the principle is often a controversial one.

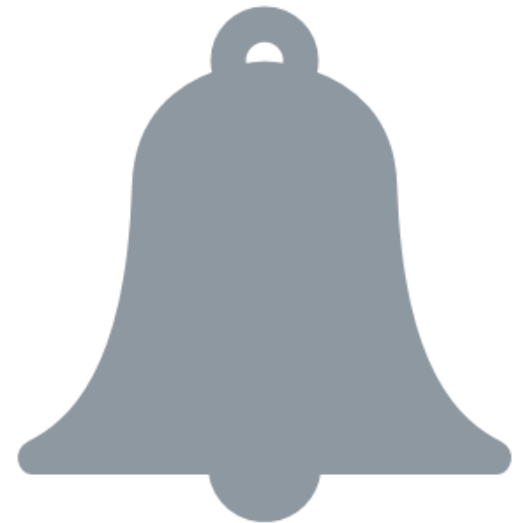
Day 6 Exit Ticket



Why don't scientists have more concrete information about the toxicity of many chemicals?

Day 7 Bell Ringer

What is the
precautionary
principle?






Lesson 13.5

How Do People Perceive and Avoid Risks?

What you will learn....

- Understand how to analyze and evaluate risks
- Identify ways to more rationally face risks
- Recognize that while some hazards are unavoidable, others can be reduced through lifestyle and choices

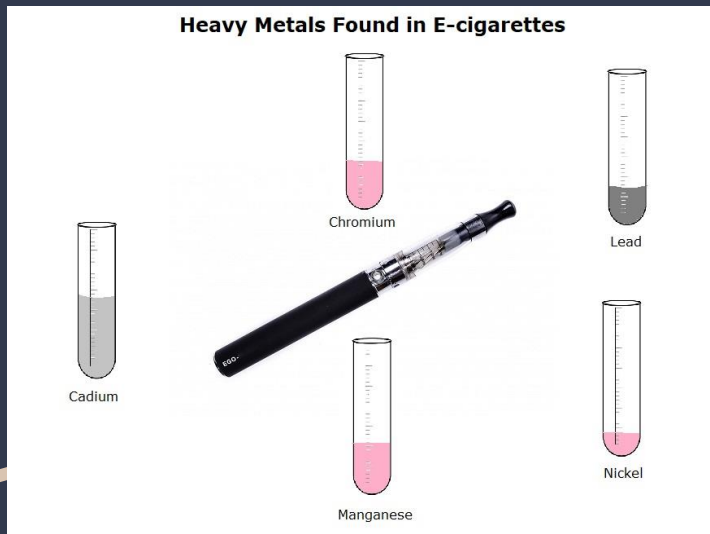
Key Terms

- toxicology
 - response
 - precautionary principle
 - toxicity
 - dose
- 

Sources of Health Risks

- Risk analysis involves identifying hazards and evaluating their risks
 - **Risk analysis**
 - Ranks risks and the best ways to manage them
 - Greatest risk of death overall is poverty

Cigarettes and E-Cigarettes



- Cigarette smoking is the leading cause of premature death among adults
- Preventable
- tobacco contributes to the deaths of 6 million people annually
- other illnesses also occur: heart disease, stroke, lung disease, type 2 diabetes, bronchitis, emphysema, memory impairment, etc...

People Evaluate Risks Irrationally

- In general, people are not very good at **assessing** risks from hazards they many encounter.
- The most dangerous thing that people do almost daily is drive or ride in a vehicle.
- People tend to **overestimate** deaths from natural disasters such as tornadoes and hurricanes, but they underestimate deaths from the flu, asthma, diabetes, etc...

Day 7 Exit Ticket

Why is poverty the greatest health risk?



Day 8 Bell Ringer



Your friend tells
you that smoking is
not dangerous.
How might you
convince him/her
otherwise?

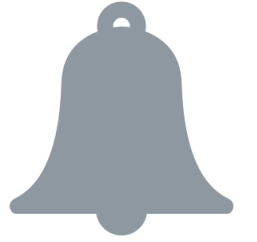
Day 8

Exit Ticket

Your friend tells you that smoking is not dangerous. How might you convince him/her otherwise?



Day 9 Bell Ringer



In what ways can the news affect one's perception about toxic chemicals and products?



Day 9 Exit Ticket

Think about the toxic chemicals that you use daily. What adjustments can you make to the products you use in order to avoid them?

