

ICATS CONTESTS

SCIENCE: COURSE OUTLINE AND LEARNING OUTCOMES

GRADE 5-6

1. THE HUMAN BODY SYSTEMS

Basic Knowledge of Human Body Systems:

- Identify and describe the major human body systems, including the circulatory system, respiratory system, digestive system, skeletal system, muscular system, and nervous system.

Structure and Function:

- Understand the basic structure and function of each body system, including key organs, tissues, and their roles in maintaining overall health.

Interactions between Systems:

- Explain how different body systems work together to perform essential functions. For example, how the circulatory system transports oxygen and nutrients to cells, or how the muscular and skeletal systems work together to enable movement.

Circulation and Respiration:

- Describe the role of the heart, blood vessels, and lungs in the circulatory and respiratory systems.
- Understand how blood carries oxygen and nutrients to cells and removes waste products.

Digestion and Nutrition:

- Explain the process of digestion and the role of the digestive system in breaking down food into nutrients for the body.
- Understand the importance of a balanced diet for overall health.

Bones and Muscles:

- Identify major bones and muscles in the body.
- Understand how muscles and bones work together to enable movement and provide support to the body.

Nervous System:

- Describe the structure and function of the nervous system, including the brain, spinal cord, and nerves.
- Explain how the nervous system sends and receives signals to control various bodily functions.

Sensory Systems:

- Explore the five senses and how they are connected to the nervous system.
- Understand how sensory organs, such as the eyes and ears, allow us to perceive the world.

Health and Well-being:

- Promote awareness of the importance of a healthy lifestyle, including good nutrition, exercise, and rest.
- Identify ways to maintain and support the health of different body systems.

Health and Safety:

- Learn about basic safety measures and injury prevention, especially related to physical activities and sports.

2. STRUCTURE AND FUNCTIONS OF PLANTS

Identify Plant Parts:

- Students should be able to identify and label the major parts of a plant, including roots, stems, leaves, flowers, and fruits.

Describe the Function of Each Plant Part:

- Students should understand the functions of these plant parts. For example, they should know that roots absorb water and nutrients, stems support the plant and transport water and nutrients, leaves perform photosynthesis, flowers are involved in reproduction, and fruits protect and disperse seeds.

Understand Photosynthesis:

- Students should have a basic understanding of the process of photosynthesis, where plants convert sunlight, carbon dioxide, and water into glucose (food) and oxygen.

Explain Plant Growth:

- Students should be able to explain how plants grow and develop, including the role of cell division, differentiation, and the importance of sunlight, water, and nutrients.

Identify Plant Adaptations:

- Students should be able to identify and describe various plant adaptations, such as thorns, spines, or waxy coatings, and how these adaptations help plants survive in different environments.

Explore Plant Life Cycles:

- Students should learn about the life cycle of plants, including seed germination, growth, flowering, and reproduction. They should understand the role of pollinators in plant reproduction.

Understand Plant Classification:

- Introduce students to basic plant classification, such as the differences between flowering and non-flowering plants, and the classification of plants into different groups (e.g., trees, shrubs, herbs).

Recognize the Importance of Plants:

- Students should understand the significance of plants in our daily lives, including their role in providing oxygen, food, medicine, and materials for various products.

Apply Knowledge to Real-Life Situations:

- Encourage students to apply their understanding of plant structure and function to real-life situations, such as gardening, agriculture, or environmental conservation.

Hands-on Activities:

- Provide opportunities for students to engage in hands-on activities like dissecting plants, growing their own plants, and conducting simple experiments to reinforce their understanding of plant structure and function.

3. CLASSIFICATION OF PLANTS AND ANIMALS

Understand the Concept of Classification:

- Define classification and explain its importance in science.

- Describe how living organisms are grouped and categorized.

Recognize and Describe Different Taxonomic Levels:

- Identify and differentiate between different taxonomic levels, such as kingdom, phylum, class, order, family, genus, and species.
- Provide examples of organisms at each taxonomic level.

Learn About the Major Kingdoms:

- Explore the five major kingdoms: Animalia, Plantae, Fungi, Protista, and Monera.
- Describe the characteristics and examples of organisms within each kingdom.

Understand the Basis of Classification:

- Explain the criteria used for classification, including anatomical features, genetic relationships, and other characteristics.
- Understand the evolving nature of classification as scientific knowledge advances.

Explore the Diversity of Plants:

- Identify and classify different types of plants, including trees, shrubs, herbs, and vines.
- Describe the key characteristics of major plant groups.

Explore the Diversity of Animals:

- Identify and classify different types of animals, including mammals, birds, reptiles, amphibians, and fish.
- Describe the key characteristics of major animal groups.

Understand the Role of Binomial Nomenclature:

- Explain the concept of binomial nomenclature developed by Carolus Linnaeus for naming species.
- Give examples of scientific names for species and understand their significance.

Explore the Process of Scientific Discovery:

- Understand how scientific classification systems have evolved over time.
- Learn about the contributions of famous scientists in the field of taxonomy and classification.

Apply Classification Principles:

- Practice classifying various organisms based on their characteristics.
- Create simple dichotomous keys for identifying common plants and animals.

Appreciate Biodiversity:

- Develop an appreciation for the incredible diversity of life on Earth and its importance for ecological balance.
- Recognize the need for conservation efforts to protect biodiversity.

4. POLLUTION

- Define pollution and distinguish between various types of pollution, such as air, water, and soil pollution.
- Explain the sources and causes of pollution, including human activities and natural processes.
- Identify common pollutants and their effects on the environment and living organisms.
- Understand the concept of pollution prevention and the importance of reducing, reusing, and recycling materials.
- Describe the greenhouse effect and its role in global climate change.
- Recognize the impact of pollution on ecosystems and biodiversity.
- Explain the importance of conservation and sustainable practices in reducing pollution.
- Analyze case studies of pollution incidents and their consequences on the environment and communities.
- Demonstrate knowledge of local and global environmental issues related to pollution.
- Discuss the role of government regulations and international agreements in addressing pollution.
- Understand the significance of responsible consumer choices in reducing pollution.
- Propose and participate in projects or activities to raise awareness and address pollution issues in their community.

5. ENVIRONMENT

Understanding Ecosystems:

- Define what an ecosystem is and identify its components (e.g., living organisms, non-living factors).

- Recognize different types of ecosystems, such as forests, deserts, and aquatic environments.
- Explain the interdependence of living organisms within an ecosystem.

Biodiversity:

- Define biodiversity and explain its importance in maintaining a healthy environment.
- Identify and classify different species of plants and animals in various ecosystems.
- Understand the concept of endangered species and the need for conservation.

Environmental Issues:

- Identify and discuss environmental problems such as pollution, deforestation, and habitat destruction.
- Explain the impact of human activities on the environment.
- Explore ways to mitigate and address these environmental issues.

Conservation and Sustainability:

- Discuss the importance of conserving natural resources (e.g., water, soil, air) and energy.
- Understand the concept of sustainability and how it relates to preserving the environment for future generations.
- Identify and discuss conservation efforts and sustainable practices.

Climate and Weather:

- Understand the difference between climate and weather.
- Explain basic climate zones (e.g., polar, temperate, tropical) and their characteristics.
- Introduce the concept of climate change and its potential consequences.

Environmental Awareness and Responsibility:

- Promote responsible environmental practices, such as reducing, reusing, and recycling.
- Discuss the importance of taking care of the environment at both local and global levels.
- Encourage a sense of environmental stewardship and respect for nature.

Scientific Inquiry:

- Develop scientific inquiry skills through observations, measurements, and experiments related to the environment.

- Collect and analyze data to draw conclusions and make predictions about environmental phenomena.

6. **FORCE**

Define Force:

Understand that a force is a push or pull that can change the motion or shape of an object.

Types of Forces:

Identify different types of forces, such as gravity, friction, magnetic force, and applied force.

Effects of Forces:

Describe how forces can change the motion of an object, including speeding it up, slowing it down, or changing its direction.

Balanced and Unbalanced Forces:

Differentiate between balanced forces (forces that cancel each other out) and unbalanced forces (forces that result in motion or acceleration).

Gravity:

Explain the concept of gravity, its role in keeping objects on Earth, and how it varies with mass and distance.

Friction:

Describe the role of friction in opposing motion and how it can be both helpful and hindering in various situations.

Measuring Force:

Understand how to measure force using units such as newtons (N) and pounds (lb).

Simple Machines:

Recognize and describe simple machines (e.g., levers, pulleys) and how they utilize forces to make tasks easier.

Forces in Nature:

Explore how forces operate in nature, such as the forces of wind, water, and tides.

Safety and Forces:

Recognize the importance of understanding forces for safety, such as seatbelts in cars and helmets for various activities.

Work:

- Define work as the product of force and distance.
- Understand that work is done when a force is applied to an object and the object moves in the direction of the force.
- Calculate work using the formula: $Work (W) = Force (F) \times Distance (d)$.

Distance:

- Define distance as the measure of how much ground an object has covered during its motion.
- Measure distances using appropriate units (e.g., meters, kilometers, or miles).
- Relate distance to the concept of displacement and how it differs in magnitude and direction.

Speed:

- Define speed as the rate of change of distance with time.
- Calculate average speed using the formula: $Speed (S) = Distance (d) / Time (t)$.
- Understand that speed can be constant or variable.

Rest/Motion:

- Differentiate between objects at rest and objects in motion.
- Understand that motion is relative to a frame of reference.
- Recognize that an object's state of rest or motion can change due to the application of force.

Law of Motion:

- Introduce Newton's laws of motion, focusing on the three laws:
 - Newton's First Law (Law of Inertia): An object at rest tends to stay at rest, and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force.
 - Newton's Second Law: The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.
 - Newton's Third Law: For every action, there is an equal and opposite reaction.

- Provide examples and applications of these laws in everyday life and in various situations.

Real-world Applications:

- Apply knowledge of forces to real-world scenarios and problem-solving, such as calculating forces in simple systems.

Hands-on Experiments:

- Participate in hands-on experiments and activities to observe and understand the principles of force in action.

7. FORMS OF ENERGY

Identify and Describe Forms of Energy:

- Students should be able to identify and describe various forms of energy, including mechanical energy, thermal energy, chemical energy, electrical energy, and radiant energy (light and electromagnetic energy).

Energy Transfer:

- Understand that energy can be transferred from one form to another and describe examples of energy transfer in everyday life, such as when a ball is thrown or food is cooked.

Conservation of Energy:

- Recognize the principle of the conservation of energy, which states that energy cannot be created or destroyed, only transferred or transformed. Students should understand that the total energy in a closed system remains constant.

Potential and Kinetic Energy:

- Differentiate between potential energy (energy of position) and kinetic energy (energy of motion). Students should be able to identify examples of objects with potential and kinetic energy.

Sources of Energy:

- Identify common sources of energy, both renewable (e.g., sunlight, wind, water) and non-renewable (e.g., fossil fuels, nuclear energy), and understand the environmental implications of using these sources.

Energy Conversion:

- Understand that energy can be converted from one form to another and provide examples of energy conversion processes, such as a car engine converting chemical energy into mechanical energy.

Energy Efficiency:

- Recognize the concept of energy efficiency and explain how some devices and systems are designed to minimize energy loss, such as energy-efficient light bulbs or hybrid vehicles.

Heat Transfer:

- Understand the three modes of heat transfer: conduction, convection, and radiation. Be able to describe examples of each and their relevance in daily life.

Sound Energy:

- Describe sound as a form of energy produced by vibrations and recognize how sound energy travels through different mediums.

Light Energy:

- Understand the properties of light energy, such as reflection, refraction, and absorption. Explain how these properties are utilized in optical devices and technologies.

Electricity:

- Explain the basics of electrical energy, including the role of electrons in electrical circuits, and demonstrate how simple circuits work.

Safety:

- Identify potential hazards related to energy use and demonstrate an understanding of safety measures when dealing with energy sources and devices.

Light:

- Understand that light is a form of energy that travels in waves.
- Describe the basic properties of light, including reflection, refraction, and dispersion.
- Explain how light interacts with objects to produce shadows and colors.
- Identify sources of light and distinguish between natural and artificial light sources.
- Understand the concept of transparency, translucency, and opacity in relation to materials.
- Explore how light can be used for communication and how optical instruments like lenses work.

Heat:

- Define heat as a form of energy and understand its connection to temperature.
- Explain the concept of thermal expansion and its practical applications.
- Describe the three methods of heat transfer: conduction, convection, and radiation.
- Investigate how different materials conduct or insulate heat.
- Understand the importance of heat in various everyday processes, such as cooking, climate control, and thermoregulation in living organisms.
- Explore the concept of energy conservation and its significance in heat transfer processes.

Sound:

- Recognize sound as a form of energy produced by vibrating objects.
- Explain how sound waves travel through different mediums, including air, water, and solids.
- Understand the properties of sound waves, including frequency, amplitude, and wavelength.

- Explore how sound can be reflected, refracted, and absorbed by different materials.
- Investigate the relationship between the pitch and frequency of sound and the volume and amplitude of sound.
- Learn about the applications of sound in communication, music, and various technologies.

8. TEMPERATURE

Understanding Temperature Scales:

- Understand and compare the Fahrenheit and Celsius temperature scales.
- Recognize that temperature is measured in degrees and that each scale has its own reference points (e.g., freezing and boiling points of water).

Measurement and Units:

- Learn to use basic temperature measuring instruments such as thermometers.
- Understand that temperature is measured in degrees (e.g., degrees Fahrenheit or degrees Celsius) and learn to read temperature values from a thermometer.

Temperature Changes:

- Identify and explain common temperature changes in their environment, such as daily and seasonal temperature variations.
- Recognize how temperature affects various materials and states of matter, such as how it can cause water to freeze or evaporate.

Heat and Energy Transfer:

- Understand the concept that temperature is a measure of the average kinetic energy of particles in a substance.
- Explore how heat energy is transferred between objects and how it can lead to temperature changes, including conduction, convection, and radiation.

Effects of Temperature on Living Things:

- Recognize how temperature affects living organisms, including how some animals hibernate or migrate in response to temperature changes.
- Understand the importance of maintaining a stable body temperature for human health and the concept of thermoregulation.

Temperature Sensitive Materials:

- Explore materials that expand or contract with changes in temperature, such as the principle of thermal expansion.
- Investigate practical applications of temperature-sensitive materials, like bimetallic strips in thermometers.

Data Collection and Interpretation:

- Collect and record temperature data using appropriate units and measurement tools.
- Interpret temperature data to draw conclusions, make predictions, and create graphs to display temperature trends.

Safety and Handling:

- Learn to handle temperature measurement tools safely and responsibly.
- Understand safety precautions related to extreme temperatures and the use of thermometers and other related equipment.

9. CHEMICAL/PHYSICAL CHANGES

Differentiating between Physical and Chemical Changes:

- Identify and describe physical changes as alterations in the state, shape, or size of matter without the formation of new substances.
- Recognize chemical changes as processes that result in the formation of new substances with different properties.

Evidence of Chemical Changes:

- Understand that chemical changes often involve the release or absorption of energy in the form of heat, light, or sound.
- Recognize common indicators of chemical changes, such as the production of gas, a color change, or the formation of a precipitate.

Chemical Reactions:

- Explore the concept of chemical reactions and that they involve the breaking and forming of chemical bonds.
- Describe simple chemical reactions, such as the reaction between baking soda and vinegar, and understand the role of reactants and products.

Conservation of Mass:

- Appreciate the law of conservation of mass, which states that the total mass of the substances involved in a chemical reaction remains constant.

States of Matter:

- Understand the three states of matter (solid, liquid, gas) and the concept of phase changes, such as melting, freezing, evaporation, and condensation.

Mixtures and Solutions:

- Differentiate between mixtures and solutions, and describe methods for separating mixtures, such as filtration and evaporation.

Acids and Bases:

- Introduce the basic properties of acids and bases, including pH scale, and their effects on indicators like litmus paper.

Common Chemical Reactions:

- Investigate and understand everyday chemical reactions, such as combustion (burning), rusting, and the role of oxygen in these processes.

Safety and Handling of Chemicals:

- Learn basic safety procedures for handling and storing chemicals, and understand the importance of responsible and safe experimentation.

Environmental Impact:

- Begin to appreciate the environmental impact of chemical changes, such as pollution, and the need for responsible waste disposal and conservation.

10. BOTANY

- Identify and describe the basic parts of a plant, including roots, stems, leaves, flowers, and fruits.
- Understand the functions of each plant part, such as photosynthesis in leaves, nutrient absorption in roots, and support in stems.
- Recognize different types of plants, including trees, shrubs, herbs, and vines, and understand their characteristics.
- Describe the life cycle of a plant, from seed germination to maturity and reproduction.

- Explain the role of flowers in plant reproduction, including the importance of pollination and fertilization.
- Recognize and understand the different methods of seed dispersal, such as wind, water, and animals.
- Identify common plant adaptations to different environments, such as deserts, forests, and wetlands.
- Understand the concept of photosynthesis and its importance in the production of food for plants.
- Investigate the role of soil and nutrients in plant growth and health.
- Describe the different types of leaves and their functions, such as photosynthesis and transpiration.
- Explain the importance of conservation and why plants are essential for the environment and human survival.

11. ASTRONOMY

Basic Celestial Observations:

- Identify and describe prominent celestial objects, including stars, planets, the Moon, and constellations.
- Understand how the position of these objects changes over time and throughout the night.

The Solar System:

- Explain the structure of the solar system, including the Sun, planets, moons, asteroids, and comets.
- Recognize the characteristics and relative sizes of the planets in our solar system.

Earth's Place in the Universe:

- Describe Earth's position in the solar system and its relationship to the Sun.
- Understand the concept of orbits and how they affect the changing seasons.

Day and Night Cycle:

- Explain the causes of day and night, including Earth's rotation on its axis.
- Understand the concept of time zones and how they relate to Earth's rotation.

Phases of the Moon:

- Describe the phases of the Moon and explain why they occur.

- Recognize the connection between the Moon's phases and its position relative to the Earth and the Sun.

Eclipses:

- Explain the different types of eclipses, both solar and lunar.
- Understand the conditions that lead to eclipses and their significance.

Constellations and Star Patterns:

- Identify common constellations and understand their cultural and historical significance.
- Describe how stars appear to move across the night sky.

The Universe and Galaxies:

- Introduce the concept of the universe as a vast, ever-expanding space.
- Describe galaxies as collections of stars, including our Milky Way.

Telescopes and Observations:

- Understand the basic functioning of telescopes and their role in astronomy.
- Describe how telescopes have advanced our understanding of the universe.

Astronomical Discoveries:

- Explore the contributions of famous astronomers and scientists to our understanding of the cosmos.
- Discuss important discoveries related to the solar system, stars, and other celestial phenomena.

Planetary Exploration:

- Learn about past and ongoing missions to explore other planets and celestial bodies.
- Discuss the potential for future space exploration.

Space Technology:

- Understand the role of technology in space exploration, including satellites and space telescopes.
- Discuss how space technology benefits life on Earth.

12. GEOLOGY

Earth's Layers:

- Understand the basic structure of the Earth, including the core, mantle, and crust. Identify the differences between these layers in terms of composition and physical properties.

Plate Tectonics:

- Introduce the concept of plate tectonics, explaining how the Earth's lithosphere is divided into plates that move, leading to the formation of mountains, earthquakes, and volcanoes. Recognize the major tectonic plate boundaries (e.g., convergent, divergent, and transform boundaries).

Volcanoes and Earthquakes:

- Explain the causes of volcanic eruptions and earthquakes. Understand the role of plate boundaries and hotspots in these geological phenomena. Describe the effects of volcanic eruptions and earthquakes on the environment and human communities.

Rocks and Minerals:

- Differentiate between rocks and minerals. Identify common minerals and rock types. Learn how rocks can be classified based on their formation and composition.

Erosion and Weathering:

- Explore the processes of weathering and erosion and their role in shaping the Earth's surface. Understand the impact of weathering and erosion on landforms and landscapes.

Fossils and Earth's History:

- Learn about fossils and how they provide evidence of past life forms on Earth. Explore the concept of geological time and the Earth's history, including the major eras and periods.

Soil Formation:

- Investigate the formation of soils and their importance in supporting plant growth and ecosystems. Understand the composition of soil and how it can vary in different regions.

Natural Resources:

- Identify and classify Earth's natural resources, such as minerals, water, soil, and fossil fuels. Discuss the importance of sustainable resource management and the consequences of resource depletion.

Landforms and Landscapes:

- Study different landforms, including mountains, valleys, canyons, plains, and coastlines. Understand how these landforms are created through various geological processes.

Environmental Impact:

- Explore the human impact on the environment, including how human activities can affect geological features and resources. Discuss the importance of responsible environmental stewardship.

Geologic Maps:

- Introduce students to geologic maps and how they are used to represent the distribution of rocks and geological features in a specific area.

Geologic Hazards:

- Discuss the potential geological hazards in different regions, such as landslides, tsunamis, and soil erosion, and the measures taken to mitigate these risks.