

РАССМОТРЕНО

УТВЕРЖДЕНО

Педагогическим советом
АНОО
«Областной технолицей
им. В.И. Долгих»
Протокол
от «21» августа
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приказом директора автономной некоммерческой
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РАБОЧАЯ ПРОГРАММА

автономной некоммерческой образовательной организации
«Областной технолицей им. В.И. Долгих»

учебного предмета
«Physics»

Для 6 класса основного общего образования
на 2023–2024 учебный год

Учителя:
В.В. Росалес
К.М. Сьерра-Теран

Московская область,
г. Истра,
с. Павловская Слобода,
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EXPLANATORY NOTE

This document outlines the goals and outcomes for teaching Physics to 6th and 7th-grade students. It combines teaching methods from Russian educational institutions and the Cambridge program to create a curriculum that balances academic rigor with practical relevance.

About Physics: Physics is a fundamental part of the natural sciences that explains the basic principles governing the universe. It explores the interactions between matter, energy, and forces to understand cosmic phenomena. It bridges theory and observation, developing thinking skills, analytical abilities, and innovative thinking.

Physics covers various topics, from basic mechanics and optics to more advanced areas like electromagnetism. It's not just theoretical; it explains everyday things, planetary mechanics, drives technological advancements, and reveals how our world works.

Program Objectives: The goals of the physics curriculum go beyond simply learning formulas. They aim to enhance cognitive skills, analytical thinking, and a deep understanding of the physical world. Here are the key objectives:

1. **Solid Conceptual Foundation:** Build a strong base of physics concepts, leading to a clear understanding of energy, motion, and forces.
2. **Analytical Thinking:** Develop the ability to analyse complex physical phenomena and draw scientifically sound conclusions.
3. **Problem-Solving Skills:** Enable students to navigate intricate situations by using systematic analytical approaches.
4. **Critical Thinking:** Foster the ability to critically assess theories, evaluate evidence, and analyse scientific literature.
5. **Rigorous Methods:** Instil appreciation for methodological rigor and scientific inquiry, promoting thoughtful hypothesis creation, experimental design, and evidence assessment.
6. **Interdisciplinary Awareness:** Show how physics relates to other fields, enriching students' perspectives.
7. **Hands-on Experience:** Provide practical skills in designing experiments, conducting research, and interpreting data.
8. **Quantitative Proficiency:** Strengthen quantitative skills, empowering students to understand data trends, draw insights, and make informed choices.
9. **Real-World Application:** Highlight physics' relevance in technology, the environment, and society.
10. **Academic Foundation:** Prepare students for further studies in physics and related subjects.
11. **Curiosity Cultivation:** Ignite a lasting interest in exploration and a passion for unravelling the mysteries of the universe.

In summary, these objectives aim to enhance cognitive skills, analytical thinking, and a deeper understanding of the natural world. Students will engage in a learning journey that builds scientific thinking and shapes their intellectual curiosity.

COURSE CONTENT

Mass and Weight Exploring the distinctions between mass and weight, understanding their measurements, and their significance in the physical world. Followed by a quiz to reinforce learning.

How Forces Act Investigating various types of forces, their effects on objects, and comprehending their influence on motion. A quiz will assess comprehension of force-related concepts.

Balanced and Unbalanced Forces Understanding equilibrium and the impact of balanced and unbalanced forces on objects. Exploring interactions between forces. Quiz to evaluate understanding of force equilibrium.

The Effects of Forces Exploring the consequences of forces on motion, including acceleration and deceleration. Followed by a quiz to assess understanding of force effects.

Forces and Energy Investigating the connection between forces and energy, and how energy transformation occurs due to forces. Quiz to reinforce the energy-force relationship.

Friction Introducing friction's role in motion and its effects on different surfaces. A subsequent quiz will evaluate comprehension of friction concepts.

Investigating Friction Hands-on experiments exploring factors influencing friction and its real-world implications. Followed by a quiz to assess experimental understanding.

Air Resistance and Drag Understanding the impact of air resistance and drag on objects moving through the air. Quiz to evaluate grasp of air resistance concepts.

Electrical Conductors and Insulators Differentiating between electrical conductors and insulators, investigating materials' electrical conductivity. Quiz to test understanding of conductivity.

Which Materials Conduct Electricity? Further exploration of material conductivity and its applications. Quiz to assess knowledge of electrical conductivity.

Does Water Conduct Electricity? Exploring water's electrical conductivity and its determinants. Quiz to evaluate comprehension of water's conductivity.

Do Different Metals Conduct Electricity Equally Well? Investigating varying metal conductivity and comparing their abilities to conduct electricity. Followed by a quiz to assess understanding.

Choosing the Right Materials for Electrical Appliances Guidance on selecting materials for electrical devices based on conductivity. Understanding real-world applications. Quiz to reinforce material selection knowledge.

Circuit Symbols Introduction to circuit symbols and their representation of components in circuits. Comprehending diagram communication. Quiz to evaluate familiarity with symbols.

Changing the Number of Components Exploring how altering component numbers in circuits affects behaviour. Understanding consequences through different setups. Quiz to assess circuit change comprehension.

Adding Different Components Discovering how introducing diverse components alters circuit behaviour. Exploring changes through practical examples. Quiz to evaluate understanding.

Length and Thickness of Wire in a Circuit Understanding wire length, thickness, resistance impact on electrical circuits. Quiz to assess grasp of concepts.

How Scientists Invented Batteries Exploring battery history and understanding underlying scientific principles. Quiz to reinforce knowledge of battery invention.

Final Exam Comprehensive assessment covering all studied topics. Testing overall comprehension of physics concepts and principles.

EDUCATIONAL OUTCOMES

PERSONALITY DEVELOPMENT OUTCOMES

Civic Education: In our physics courses, students engage in collaborative explorations that mirror real-world phenomena. Through group activities focused on solving physics problems, students not only grasp scientific concepts but also understand the significance of teamwork and effective communication. This collaborative approach exposes them to diverse viewpoints as peers approach challenges from different angles. This nurtures active listening, idea-sharing, and considering alternative solutions—a vital aspect of civic participation that extends beyond the physics classroom.

Patriotic Education: Physics knows no boundaries, and in our course, students explore how physical principles are present in various cultures and historical contexts. By investigating the scientific contributions of different societies, students gain a deeper appreciation for the interconnectedness of scientific knowledge across the world. This exposure fosters a sense of pride in their own scientific heritage while also encouraging curiosity about others.

Spiritual and Moral Education: Physics provides opportunities for students to make ethical decisions, particularly in cases involving data interpretation and problem-solving. Through discussions on honesty, integrity, and accuracy in scientific work, students internalize the importance of ethical behaviour. They learn that honesty is a fundamental value in physics, just as it is in personal interactions.

Aesthetic Education: Symmetry, patterns, and beauty are inherent to physics, and our curriculum frequently delves into these captivating areas. Students explore the visual allure and mathematical elegance of physical concepts. By recognizing patterns and appreciating the aesthetic appeal of scientific principles, students cultivate a keen aesthetic sense that extends beyond calculations and equations.

Physical Education, Formation of Health Culture, and Emotional Well-being: While physics often involves abstract reasoning, our course incorporates activities that integrate physical movement. Physics-related activities that require movement or hands-on experiments not only enhance understanding but also promote physical well-being and coordination. Additionally, lessons encompassing data analysis related to health and wellness facilitate discussions about emotional health and self-care.

Labour Education: Solving physics problems requires dedication, perseverance, and the willingness to tackle challenges. Our physics course introduces students to progressively complex problems that demand sustained effort. As they work through these challenges, students learn the value of hard work and experience the satisfaction that comes from overcoming obstacles—a lesson that prepares them for future endeavours.

Environmental Education: Physics has a practical application in addressing real-world issues, including environmental challenges. Students engage with data related to environmental matters, such as energy consumption or climate change. By analysing data and discussing potential solutions, students understand how physics can be used to contribute to a more sustainable future.

Adaptation of the Learner to Changing Conditions of Social and Natural Environment: Physics is dynamic and adaptable, reflecting changing realities. In our

physics course, students encounter problems that involve changing variables or evolving situations. By navigating through these scenarios, students learn to think critically, make decisions based on new information, and adapt their strategies—a skill that extends beyond physics and prepares them for life's evolving challenges.

INTERDISCIPLINARY OUTCOMES

1. Proficiency in Cross-Disciplinary Cognitive Skills

In the context of physics education, students cultivate a diverse set of cross-disciplinary cognitive skills that extend beyond the boundaries of the subject, fostering holistic intellectual growth. These skills empower students to navigate the complexities of physics concepts and apply their competencies across a range of fields. The following subsections outline key cognitive skills within this framework:

Foundational Analytical Proficiencies: At the core of interdisciplinary physics learning lies the mastery of foundational analytical proficiencies. Students hone their critical thinking abilities, analytical aptitudes, and the skill of inference. They become skilled in identifying patterns within physical phenomena, analysing relationships between different scientific concepts, and constructing robust scientific arguments. This skillset equips students with problem-solving tools that extend beyond physics and enable them to make well-informed decisions in various contexts.

Data Interpretation and Modelling: Fluency in handling scientific data is essential for interdisciplinary competence. Students develop the capability to gather, assess, and synthesize scientific data from diverse sources. They refine their ability to interpret data presented in numerical and graphical formats, distinguish between reliable and unreliable scientific sources, and organize scientific information coherently. These proficiencies empower students to engage with intricate scientific ideas, approach research tasks confidently, and contribute meaningfully to discussions spanning multiple subjects.

Application of Mathematical Frameworks: Physics often involves mathematical descriptions of natural phenomena. Students adeptly apply mathematical frameworks to analyse and solve physical problems. They grasp the art of translating real-world scenarios into mathematical equations, manipulate mathematical expressions to derive insights, and interpret mathematical results in the context of physical reality. This skill empowers students to bridge the gap between theoretical mathematics and its practical application in understanding the physical world.

Through the cultivation of these cross-disciplinary cognitive skills, students excel not only in physics but also develop abilities crucial for lifelong learning and active engagement with a dynamic world. The refinement of foundational analytical proficiencies, data interpretation skills, and the application of mathematical frameworks enables students to confidently explore various scientific domains, tackle intricate challenges, and provide insightful contributions that enrich a wide range of academic and real-world contexts.

2. UNIVERSAL ACADEMIC COMMUNICATIVE SKILLS

Within the domain of physics education, students cultivate a suite of universal academic communicative skills that transcend the confines of the subject, nurturing comprehensive intellectual growth. These skills empower students to effectively communicate intricate physics concepts, collaborate seamlessly with peers, and actively engage within diverse physics learning contexts. The following subsections elucidate key communicative actions within this physics framework:

Communication: Effective communication stands as a cornerstone of physics comprehension. Students refine their ability to convey complex physical ideas both in written and spoken forms. They cultivate the skill of elucidating intricate scientific concepts using accessible language, ensuring their peers grasp the nuances of their reasoning. By mastering communication skills, students adeptly articulate their physics insights across a range of topics.

Collaborative Endeavours: Collaborative activities play a pivotal role in fostering physics learning. Students engage in group tasks that require them to exchange scientific strategies, explore diverse problem-solving approaches, and collectively dissect complex physics challenges. They embrace a respect for varied scientific viewpoints, contribute meaningfully to physics discussions, and synthesize group insights into coherent solutions. Through collaborative ventures, students cultivate teamwork and negotiation skills relevant to physics and real-world contexts alike.

3. UNIVERSAL ACADEMIC REGULATORY ACTIONS

Mastering Self-Regulation in Physics Learning:

In the domain of physics education, students cultivate a set of universal academic regulatory actions that extend beyond the boundaries of the subject, fostering their comprehensive intellectual development. These actions empower students to navigate physics challenges with self-organization, enhance emotional intelligence, and develop a sense of self-acceptance and empathy for others. The following subsections elucidate key regulatory actions within this physics framework:

Self-Organization: Effective learning in physics demands self-organization. Students develop skills in time management, goal setting, and planning their physics tasks. They learn to break down intricate scientific problems into manageable steps, enhancing their efficiency in problem-solving. By mastering self-organization, students gain the ability to approach physics challenges systematically, promoting effective scientific exploration.

Emotional Intelligence: Emotional intelligence plays a pivotal role in physics learning. Students cultivate an awareness of their emotional responses to physics challenges and learn to manage frustration and anxiety. They also develop empathy toward their peers' struggles, fostering a supportive learning environment. By enhancing emotional intelligence, students are better equipped to confront physics difficulties with resilience and a positive mindset.

Self-Acceptance and Empathy: Physics can present challenges, but fostering

self-acceptance is paramount. Students learn to embrace mistakes as opportunities for growth and understand that learning is an ongoing process. They also develop empathy toward their peers, recognizing that everyone possesses unique strengths and weaknesses in physics. By nurturing self-acceptance and empathy, students contribute to a positive physics learning community.

Through the cultivation of these universal academic regulatory actions, students not only excel in physics competence but also acquire abilities crucial for lifelong learning and active participation in a dynamic world. The development of self-organization, emotional intelligence, and a sense of self-acceptance and empathy equips them to confidently navigate physics challenges, collaborate effectively, and contribute positively across a diverse spectrum of physics and practical contexts.

SUBJECT OUTCOMES

Throughout our physics curriculum, students will engage in a series of lessons designed to cultivate a comprehensive understanding of fundamental principles and practical applications within the realm of physics. These lessons are carefully structured to foster cognitive growth, analytical acumen, and a deep appreciation for the dynamic interactions shaping the natural world. The following outlines the key subject outcomes for each lesson:

1. **Mass and Weight:**
 - Develop a clear distinction between mass and weight.
 - Understand the measurements and units associated with mass and weight.
 - Comprehend the gravitational force's influence on objects.
2. **How Forces Act:**
 - Identify and categorize different types of forces.
 - Understand how forces affect the motion of objects.
 - Demonstrate knowledge of Newton's laws of motion.
3. **Balanced and Unbalanced Forces:**
 - Define equilibrium and its relation to balanced forces.
 - Differentiate between balanced and unbalanced forces.
 - Analyse the effect of forces on an object's state of motion.
4. **The Effects of Forces:**
 - Grasp the concept of acceleration and its connection to forces.
 - Investigate the impact of forces on an object's velocity and momentum.
 - Apply force principles to real-world scenarios.
5. **Forces and Energy:**
 - Explore the relationship between forces and energy transformation.
 - Understand concepts of kinetic and potential energy.
 - Analyse how forces affect an object's energy state.
6. **Friction:**
 - Recognize the role of friction in motion.
 - Differentiate between static and kinetic friction.
 - Calculate frictional forces in various contexts.
7. **Investigating Friction:**
 - Design and conduct experiments to measure frictional forces.
 - Identify factors affecting friction and their implications.
 - Analyse experimental data to draw conclusions.
8. **Air Resistance and Drag:**
 - Understand the effects of air resistance on moving objects.
 - Investigate the factors influencing air resistance.
 - Apply knowledge to explain real-world phenomena.
9. **Electrical Conductors and Insulators:**
 - Differentiate between conductors and insulators.
 - Investigate materials' electrical conductivity.
 - Explain the significance of conductive and insulating materials.
10. **Which Materials Conduct Electricity?**
 - Further explore material conductivity and its applications.
 - Investigate the factors affecting electrical conductivity.

- Analyse the relationship between conductivity and real-world scenarios.
11. **Does Water Conduct Electricity?**
 - Explore water's electrical conductivity and its determinants.
 - Understand the role of dissolved ions in water's conductivity.
 - Apply knowledge to discuss safety and practical applications.
 12. **Do Different Metals Conduct Electricity Equally Well?**
 - Investigate variations in metal conductivity.
 - Compare metals' abilities to conduct electricity.
 - Analyse the factors influencing metal conductivity.
 13. **Choosing the Right Materials for Electrical Appliances:**
 - Learn to select materials based on their electrical properties.
 - Understand the role of conductivity in designing electrical devices.
 - Apply knowledge to evaluate materials for specific applications.
 14. **Circuit Symbols:**
 - Familiarize with symbols representing circuit components.
 - Understand how circuit diagrams communicate electrical setups.
 - Interpret and create basic circuit diagrams.
 15. **Changing the Number of Components:**
 - Investigate how altering components affects circuit behaviour.
 - Analyse the impact of adding or removing elements in a circuit.
 - Understand the implications for voltage, current, and resistance.
 16. **Adding Different Components:**
 - Explore the effects of introducing diverse components in a circuit.
 - Analyse how different elements interact in circuitry.
 - Apply knowledge to predict circuit behaviour.
 17. **Length and Thickness of Wire in a Circuit:**
 - Understand the relationship between wire properties and circuit behaviour.
 - Investigate how wire length and thickness affect resistance.
 - Analyse data to draw conclusions about wire resistance.
 18. **How Scientists Invented Batteries:**
 - Explore the historical development of batteries.
 - Understand the scientific principles behind battery operation.
 - Discuss the significance of batteries in modern technology.

In summation, these subject outcomes encompass a comprehensive journey through the principles and applications of physics. Students will emerge from this curriculum equipped with a deep understanding of physical phenomena, analytical skills, and the ability to apply physics concepts to real-world contexts. This foundation will serve as a stepping stone for further exploration, academic pursuits, and engagement with the intricacies of the natural world.

LESSON PLAN

Lesson number	Theme	Homework
1	Mass and weight	Activity book pp.37,38
2	Quiz: Mass and weight	
3	How forces act	Activity book pp.39,40
4	Quiz: How forces act	
5	Balanced and unbalanced forces	Activity book pp.41,42
6	Quiz: Balanced and unbalanced forces	
7	The effects of forces	Activity book pp.43,44
8	Quiz: the effects of forces	
9	Forces and energy	Activity book pp.45,46
10	Quiz: forces and energy	
11	Friction	Activity book pp.47,48
12	Quiz: friction	
13	Investigating friction	Activity book pp.49,50
14	Quiz: investigating friction	
15	Air resistance and drag	Activity book pp.51,52
16	Quiz: Air resistance and drag	
17	Electrical conductors and insulators	Activity book pp.53,54
18	Which materials conduct electricity?	Activity book pp.54,55
19	Does water conduct electricity	Activity book pp.55,56

20	Quiz	
21	Do different metals conduct electricity equally well?	Activity book pp.57,58
22	Quiz	
23	Choosing the right materials for electrical appliances	Activity book pp.59,60
24	Circuit symbols	Activity book pp.60,61
25	Quiz	
26	Changing the number of components	Activity book pp.62,63
27	Adding different components	Activity book pp.63,64
28	Quiz	
29	Length and thickness of wire in a circuit	Activity book pp.65,66
30	How scientist invented batteries	Activity book pp.66,67
31	Quiz	
32	Exam	

EDUCATIONAL AND TEACHING SUPPORT FOR THE EDUCATIONAL PROCESS

COMPULSORY MATERIALS FOR THE STUDENT

Wood, Mary Low, Emma Byrd, Greg Byrd, Lynn. Cambridge Primary Science 6 Student's book. Cambridge Education. 2014;

TEACHER'S BOOK AND RESOURCES

Wood, Mary Low, Emma Byrd, Greg Byrd, Lynn. Cambridge Primary Science 6 Teacher's book. Cambridge Education. 2014;

DIGITAL RESOURCES AND INTERNET RESOURCES

<https://phet.colorado.edu/en/simulations/browse>

MATERIAL AND TECHNICAL SUPPORT FOR THE EDUCATIONAL PROCESS

TEACHING EQUIPMENT

Projector, computers, tablets, interactive whiteboard, notebooks, pens.

EQUIPMENT FOR PRACTICAL WORK

Projector, computers, tablets, interactive whiteboard, notebooks, pens.