

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 общеобразовательной организации
«Областной технолицей им. В.И. Долгих»

учебного предмета
«Physics»

Для 7 класса основного общего образования
на 2023–2024 учебный год

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Московская область,
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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 course on forces and motion, students will embark on a comprehensive journey to explore the fundamental principles governing the interactions between forces and the resulting motion of objects. This curriculum is thoughtfully designed to cultivate a deep understanding of the dynamics underlying the natural world, fostering analytical thinking and practical application. The following outlines the key subject outcomes for each module:

1. Seeing Forces:

- Develop a heightened awareness of forces as agents of change in the realm of motion.
- Recognize the discernible effects of forces on the behavior of objects.
- Acquire the ability to identify and articulate various common forces across diverse scenarios.

2. Forces Big and Small:

- Grasp the concept that forces manifest in varying magnitudes and directions.
- Explore the extensive spectrum of forces, spanning from gravitational to electromagnetic.
- Understand vector representation as a means to depict and understand forces comprehensively.

3. Weight - The Pull of Gravity:

- Gain a clear understanding of weight as the manifestation of gravitational force on an object.
- Learn the methodology to calculate weight using mass and the acceleration due to gravity.
- Apply weight calculations to real-world scenarios and practical contexts.

4. Friction - An Important Force:

- Engage with the concept of friction as a significant resistive force in the context of motion.
- Investigate the underlying factors influencing the magnitude of frictional forces.
- Apply acquired knowledge about friction to dissect and comprehend real-world scenarios.

5. Air Resistance:

- Develop an understanding of air resistance as a crucial opposing force in motion.
- Explore the intricate relationship between air resistance and the movement of objects.
- Analyze the varying effects of air resistance across different physical environments.

6. Patterns of Falling:

- Comprehend the intricate interplay between force and motion during the process of free fall.
- Acquire the proficiency to calculate and predict motion characteristics during free fall.
- Apply the principles of free fall to interpret and explain diverse scenarios involving gravitational motion.

7. Energy:

- Develop a comprehensive understanding of the concept of energy in the context of physics.
- Identify various forms of energy and their interconnections within physical systems.
- Analyze the conservation and transformation of energy across different scenarios.

8. Using Energy:

- Apply the concept of energy to solve practical problems involving forces and motion.
- Understand the relationship between work, force, distance, and energy transfer.
- Explore the role of energy in performing mechanical tasks.

9. Chemical Stores of Energy:

- Explore the concept of energy storage in chemical systems.
- Investigate chemical reactions as a source of stored energy release.
- Analyze the practical implications of chemical energy storage and release.

10. More Energy Stores: - Identify and comprehend additional forms of energy storage, including elastic and gravitational potential energy. - Explore the conversion of energy between different storage forms. - Analyze real-world scenarios involving various energy transformations.

11. Thermal Energy: - Understand the concept of thermal energy and its connection to temperature. - Investigate the transfer of thermal energy through conduction, convection, and radiation. - Apply knowledge of thermal energy to explain everyday phenomena.

12. Kinetic Energy: - Develop a clear grasp of kinetic energy and its relationship to motion. - Explore the factors influencing the magnitude of an object's kinetic energy. - Apply kinetic energy concepts to predict and analyze motion scenarios.

13. Energy on the Move: - Comprehend the principles of energy conservation in dynamic systems. - Explore how energy is transferred and transformed within moving systems. - Analyze the role of energy in various mechanical systems.

14. Energy Changing Form: - Investigate the conversion of energy between different forms within complex systems. - Understand the efficiency of energy transformations and the concept of dissipation. - Apply knowledge of energy changing forms to real-world devices and processes.

15. Energy is Conserved: - Grasp the fundamental principle of the conservation of energy. - Apply the conservation of energy principle to solve dynamic problems involving forces and motion. - Analyze complex scenarios to demonstrate the universal nature of energy conservation.

16. The Day and Night: - Explore the phenomenon of day and night and its connection to Earth's rotation. - Understand the apparent motion of celestial bodies due to Earth's rotation. - Analyze the effects of Earth's rotation on the measurement of time.

17. The Starring Skies: - Develop an understanding of stars as distant celestial objects. - Explore the concept of light-years and the immense scales of the universe. - Analyze the characteristics and classifications of stars based on their properties.

18. The Moving Planets: - Grasp the concept of planetary motion within our solar system. - Understand the dynamics of orbital motion and Kepler's laws. - Analyze the orbital characteristics and behaviors of various planets.

19. Seeing Stars and Planets: - Explore observational techniques to study stars and planets. - Understand how telescopes and other tools enhance astronomical observations. - Apply knowledge to interpret celestial phenomena through observations.

20. The Moon and Its Phases: - Investigate the moon's phases and their relation to its position and illumination. - Understand the lunar cycle and the causes behind the changing appearance of the moon. - Analyze how moon phases influence earthly phenomena and human culture.

21. A Revolution in Astronomy: - Explore the historical advancements and paradigm shifts in the field of astronomy. - Understand the contributions of key astronomers to our understanding of the universe. - Analyze how breakthroughs in astronomy have shaped human knowledge.

22. Journey into Space: - Engage with the exploration of space beyond our planet. - Understand the challenges and achievements of human space travel. - Analyze the potential implications of future space exploration endeavors.

In conclusion, these subject outcomes encapsulate the comprehensive journey of our forces and motion curriculum. Students will emerge from this course equipped with a profound understanding of the intricate interplay between forces and motion, as well as the broader concepts of energy and celestial phenomena. This foundation will empower them to explore the mysteries of the natural world, apply analytical skills, and contribute to the ongoing pursuit of scientific understanding.

LESSON PLAN

Lesson number	Theme	Homework
1	Forces and motion	Activity book pp73
2	Seeing forces	Worksheet
3	Forces big and small	Worksheet
4	Weight - the pull of gravity	Activity book pp.74-75
5	Quiz	Review all the vocabulary
6	Friction - an important force	Activity book pp.75-77
7	Air resistance	Worksheet
8	Review	
9	Patterns of falling	Activity book pp.78
10	Exam	
11	Energy	Activity book pp.79-81
12	Using energy	Worksheet
13	Chemical stores of energy	Activity book pp.82
14	Quiz	
15	More energy stores	
16	Thermal energy	Worksheet
17	Kinetic energy	Worksheet
18	Quiz	
19	Energy on the move	
20	Energy changing form	Worksheet
21	Quiz	
22	Energy is conserved	Worksheet
23	Exam	
24	The day and night	Activity book pp.90

25	The starring skies	Activity book pp.91
26	The moving planets	Activity book pp.92
27	Quiz	
28	Seeing stars and planets	Activity book pp.92 Do another planet
29	The moon and its phases	Activity book pp.93
30	Quiz	
31	A revolution in astronomy	Worksheet
32	Journey into space	Worksheet

**EDUCATIONAL AND TEACHING SUPPORT FOR THE
EDUCATIONAL PROCESS**

COMPULSORY MATERIALS FOR THE STUDENT

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

TEACHER'S BOOK AND RESOURCES

Wood, Mary Low, Emma Byrd, Greg Byrd, Lynn. Cambridge Checkpoint Science 7 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.