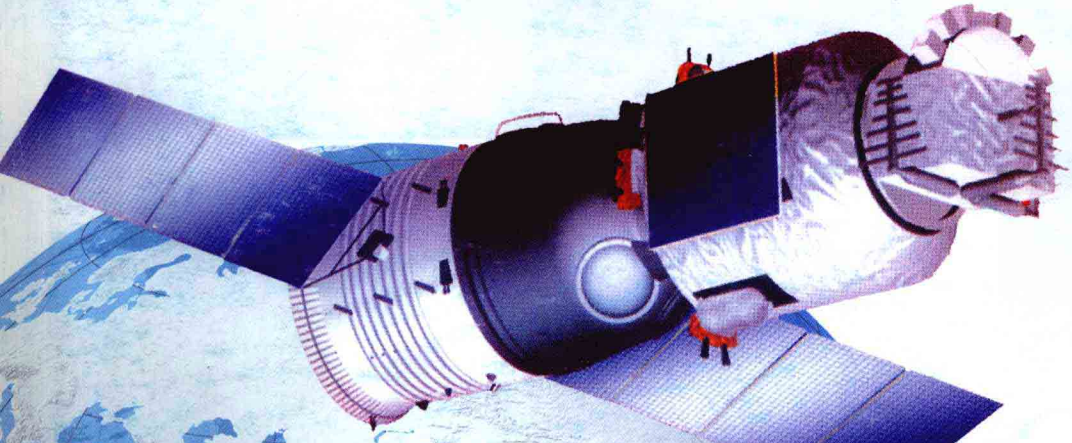
英语版

全日制普通高级中学教科书（试验修订本·必修）

PHYSICS

第一册

课程教材研究所
双语课程教材研究开发中心 组译



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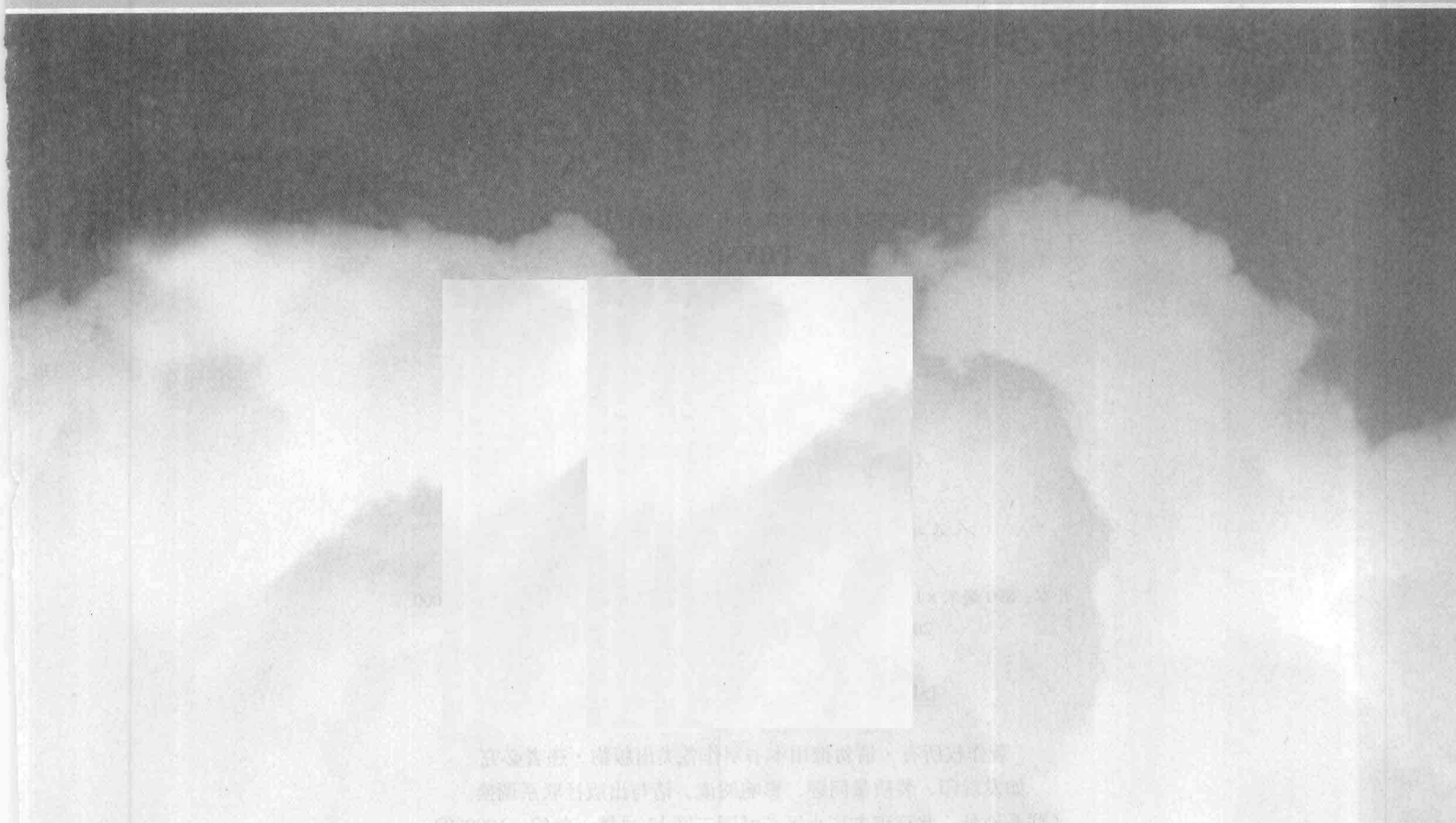

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高中《物理》教科书
说　明

《全日制普通高级中学教科书（试验修订本·必修）物理第一册》是根据教育部2000年颁布的《全日制普通高级中学课程计划（试验修订稿）》和《全日制普通高级中学物理教学大纲（试验修订版）》的规定，遵照1999年全国教育工作会议的精神，在两省一市进行试验的《全日制普通高级中学教科书（试验本）物理》一、二两册的基础上进行修订的．此次修订的指导思想是：遵循“教育要面向现代化，面向世界，面向未来”的战略思想，贯彻教育必须为社会主义现代化建设服务，必须与生产劳动相结合，培养德、智、体、美全面发展的社会主义事业的建设者和接班人的方针，以全面推进素质教育为宗旨，全面提高普通高中教育质量．

普通高中教育，是与九年义务教育相衔接的高一层次的基础教育．高中教材的编写，旨在进一步提高学生的思想道德品质、文化科学知识、审美情趣和身体心理素质，培养学生的创新精神、实践能力、终身学习的能力和适应社会生活的能力，促进学生的全面发展，为高一级学校和社会输送素质良好的合格的毕业生．

本书内容分必学和选学．有＊号者为选学内容，教师可根据实际情况选用．

学生实验集中列在课文之后，应配合教学进度适时进行．

必做的演示实验在课文中列出，教师可根据实际情况或者进行演示，或者组织学生随堂实验．

“做一做”介绍简单易行的实验，应尽力组织学生课外完成．

书后列有供学生选做的研究课题示例，希望老师和学生能够创造性地完成．

书中正文之外还设有“阅读材料”、“思考与讨论”、“做一做”、“旁批”等栏目，以开阔眼界，启发思考，有利于学生掌握知识和提高能力．

本书配有教学录像带两盒，介绍教学中或实验室中不易观察的现象和实验过程，以利于教学．与本书有关的资料已经放在人民教育出版社“中学物理”网站 www.pep.com.cn/wl/中，欢迎浏览，并通过网站与我们联系．

本教材原试验本由张同恂、扈剑华主持编写，参加编写的有：张同恂、扈剑华、彭前程、马冬玲、张颖、周誉蔼，责任编辑为彭前程．绘图朱静、王恒东．版式设计马迎莺．终审张同恂．

参加本次修订的有：张同恂、扈剑华、彭前程、张大昌，终审张同恂．

本书在编写过程中得到专家、教师和教学研究人员的支持和帮助，特别得到两省一市

试验地区教师和学生的大力支持，在此表示深切的感谢.

本次修订，黄恕伯等同志提供了部分习题，在此一并致谢.

为适应各地的不同情况，便于教师灵活掌握教学进度，本册教材共安排了9章内容. 教学中若高一课时较少，可将第9章安排在高二学习.

因水平有限，编者虽勉力为之，但难免有错误和不妥之处. 欢迎试验地区师生和广大读者提出意见和建议，以利于修改和完善.

本册教材经教育部中小学教材审定委员会审读，尚待审查.

Preface

Hello, students!

Your senior middle school studies have begun. Welcome to the study of senior middle school physics. You have learned some knowledge of physics in your journey through junior middle school, but it was only the first step in your study of physics, and you should further develop your knowledge in this field. Senior middle school physics will open up for you a more brilliant and beautiful world than junior middle school physics. Let us glance over how extensive, useful and interesting the world of physics is before we start our study.

Here are some interesting experiments.

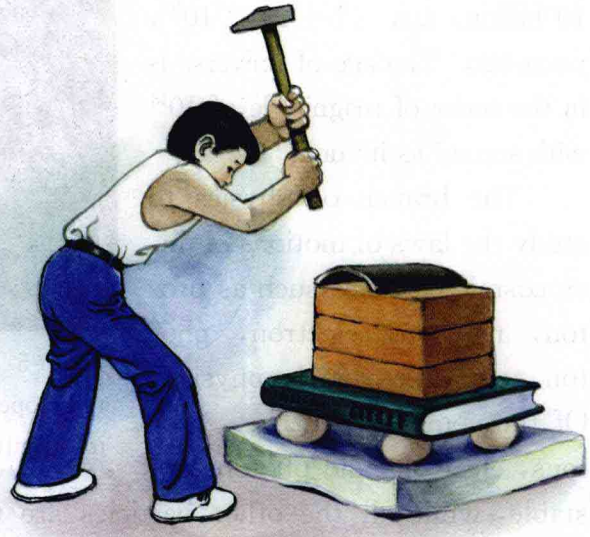


Fig. 0-1 Which will be broken, the tile or the egg?

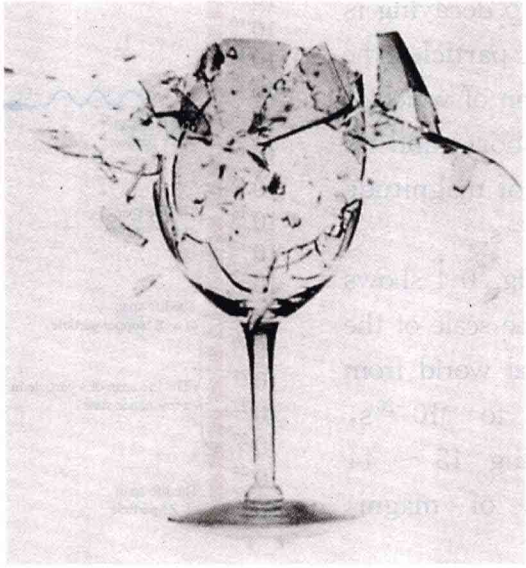


Fig. 0-2 How can sound break the wineglass into pieces?

Fig. 0-3 The bird in the electrified cage remains safe and sound.

Physics is the study of the structure of substance and the basic laws of motion

There are a lot of branches in physics, such as mechanics, heat, electromagnetism, optics, statistical physics, quantum mechanics, atom and atomic nucleus physics, condensed state (solid and liquid states) physics and particle physics (high energy) etc. The study scope of physics is very vast.

Seeing in terms of measuring time

Modern standard universe theories theorize that the universe was born in a big bang more than 10 billion, i. e. $\{1 \sim 2\} \times 10^{10}$, years ago. The age of universe is in the order of magnitude of 10^{18} with second as its unit.

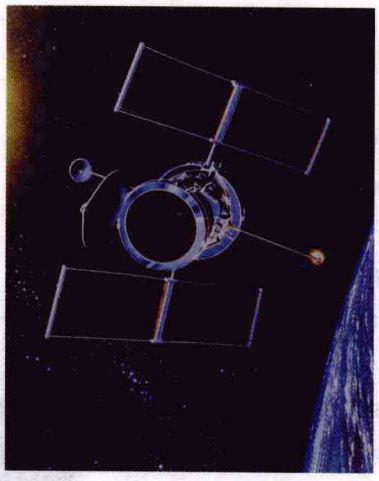


Fig. 0-5 The Hubble space telescope used to survey the information of the universe.

The branch of physics to study the laws of motions of microcosmic particles such as proton, neutron, electron, photon, etc., is particle physics. Of the common particles, protons, electrons and photons are stable, while all the other particles are unstable. That is, they decay and become other particles after a certain time, and the average time of a particle from its emerging to decaying is called its life span. There is a kind of microcosmic particle, the life span of which is very short, and its order of magnitude is 10^{-25} s.

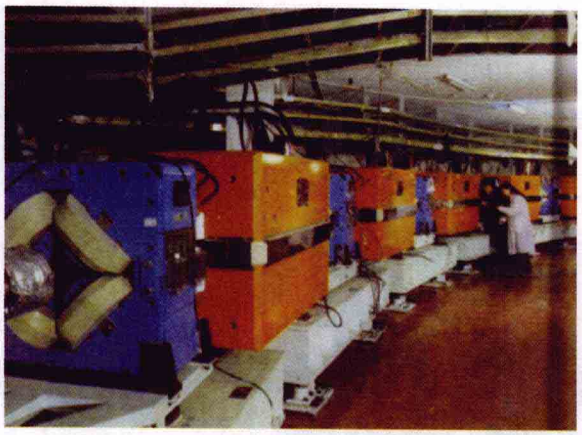


Fig. 0-6 The positive and negative electron colliding machine in Beijing, China, used for exploring the motion laws of microcosmic particles. (The figure shows the store ring of the machine.)

Fig. 0-4 shows the time scale of the material world from 10^{18} s to 10^{-25} s, spanning 43 ~ 44 orders of magnitude.

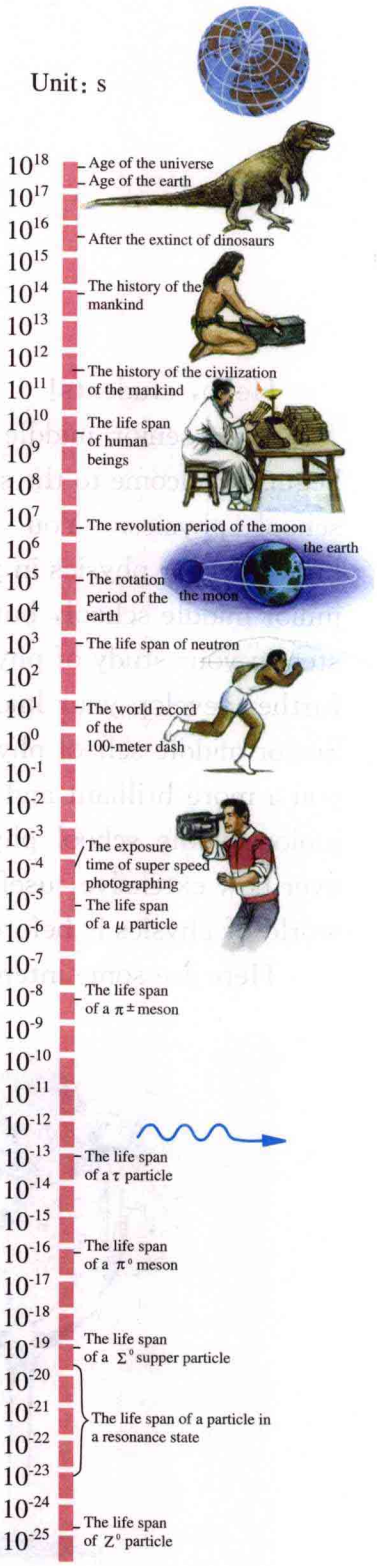


Fig. 0-4 The time scale of the material world

Seeing in terms of measuring space

The smallest object studied in physics is a microcosmic particle with the order of magnitude of 10^{-15} m, while the greatest object is the universe with the order of magnitude of (10^{26}～10^{27}) m. Fig. 0-7 is the measure of space in the material world spanning 42～43 orders of magnitude, from 10^{-15} m to (10^{26}～10^{27}) m.

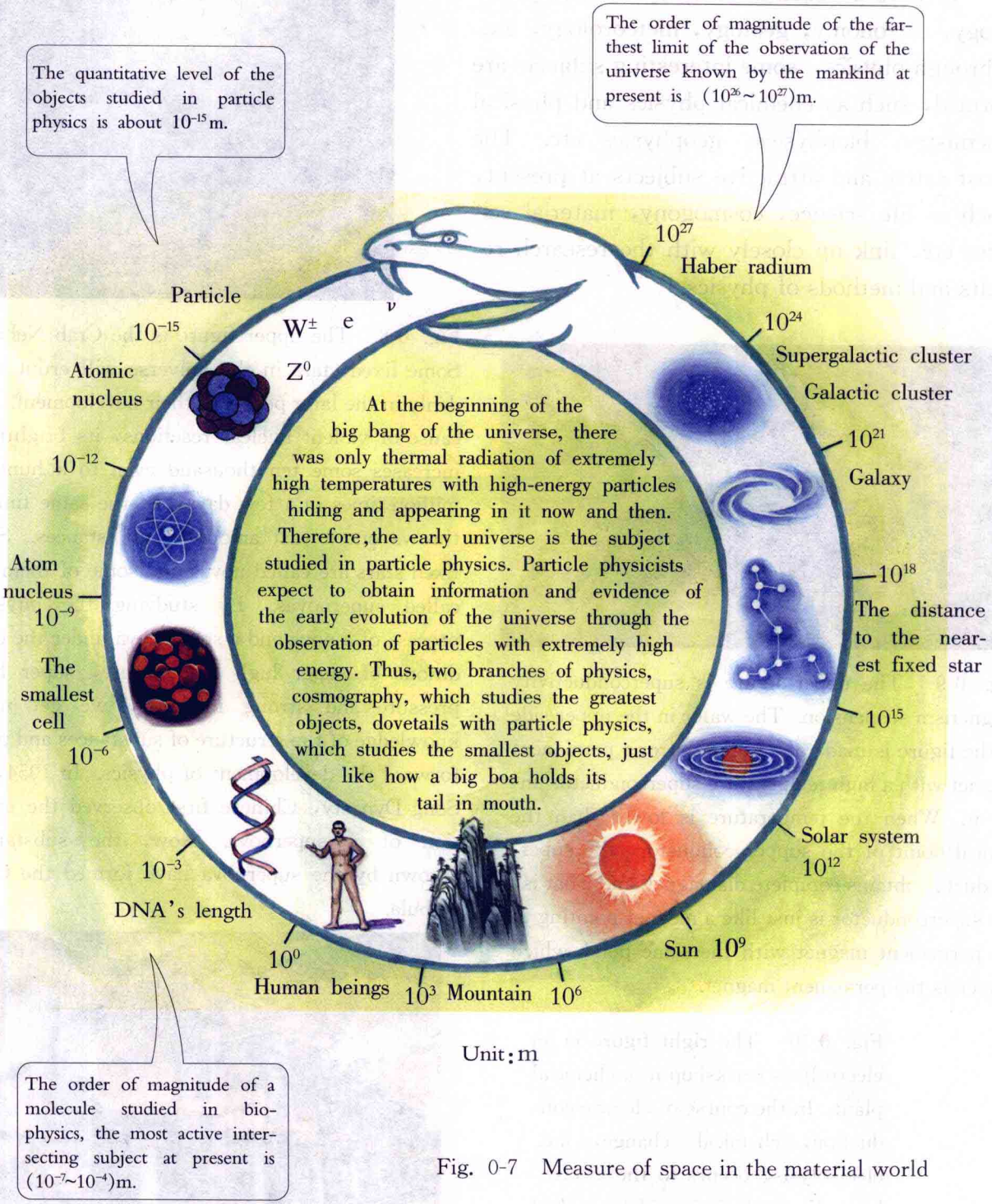


Fig. 0-7 Measure of space in the material world

Physics is one of the bases of natural science. The achievements and methods of physical study play an important role in every field of natural science.

Physics is required to study chemistry, biology, astronomy, geology, meteorology, etc. Through physics, some interesting subjects are formed, such as chemical physics and physical chemistry, biophysics, geophysics etc. The most active and attractive subjects at present, such as life science, cosmogony, material science etc, link up closely with the research results and methods of physics.

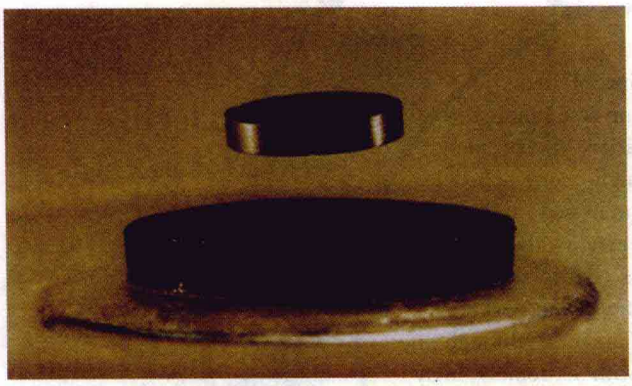


Fig. 0-9 The upper figure is superconductivity magnetism suspension. The wafer in the upper side of the figure is made of a supper strong permanent magnet with a high temperature superconductor under it. When the temperature is lower than the critical point of the supper conductor, the superconductor obtains complete diamagnetism. That is, the superconductor is just like a magnet pointing to the permanent magnet with the same pole, which suspends the permanent magnet.

Fig. 0-8 The upper figure is the Crab Nebula. Some fixed stars in the universe will erupt suddenly in the later period of their development. Because of violent nuclear reactions, its brightness increases some ten thousand even to a hundred million times in a few days. At the same time it throws out a vast amount of substances. Such fixed stars are called novas and some of them are called supernovas. By studying the physical process of a nova and a super nova under the conditions of super high temperature, super high pressure and strong radiation, we get more knowledge of the structure of substances and push forward the development of physics. In 1054, in Song Dynasty, Chinese first observed the eruption of a supernova. Now, the substances thrown by the supernova have formed the Crab Nebula.

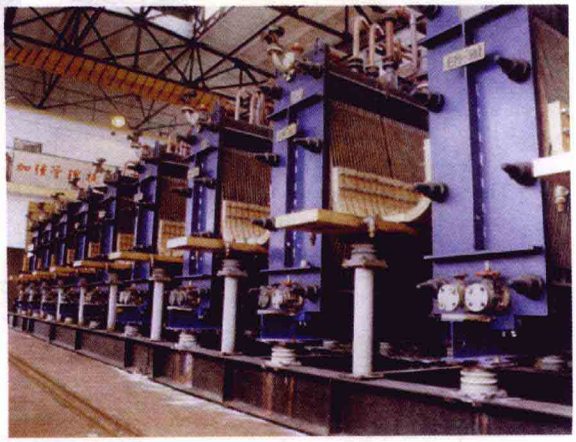


Fig. 0-10 The right figure is an electrolysis workshop in a chemical plant. In the course of electric conduction, chemical change, i. e. electrolysis, occurs to the electrolyte. Electrolysis is widely applied in industry.

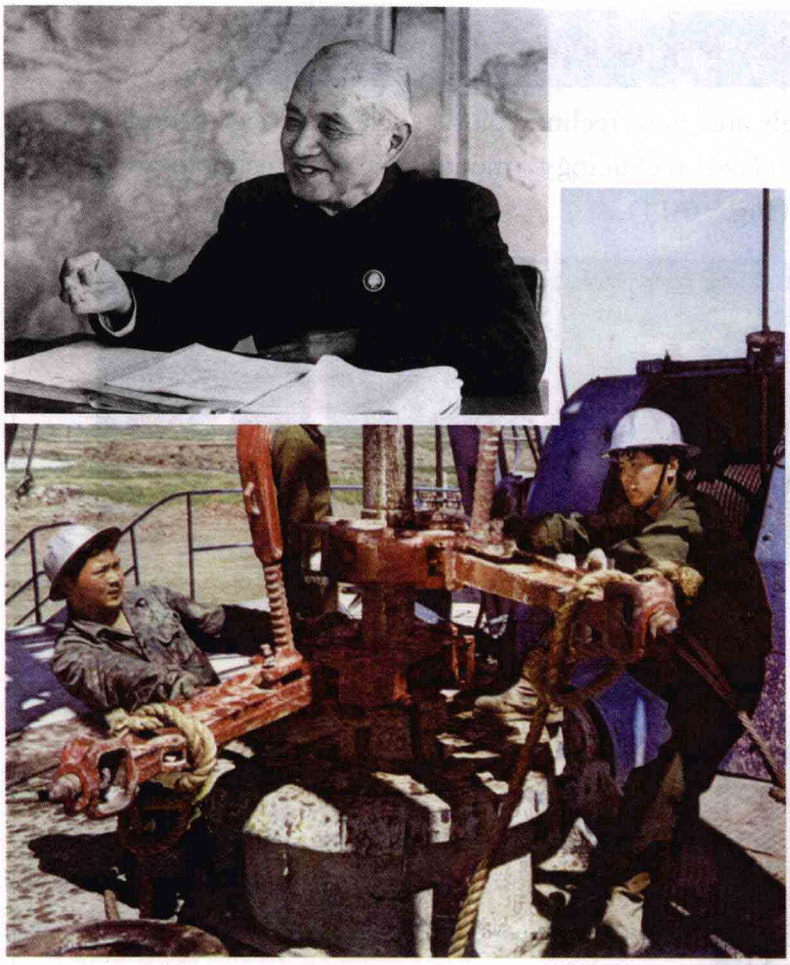


Fig. 0-11 Geomechanics is the science of using mechanic viewpoints to study crustal movement. The Chinese scientist Li Siguang (the left upper photo) founded geomechanics, and his scientific researches guided the discovery of Daqing, Shengli and Dagang oil fields and pointed out the direction of earthquake prediction.

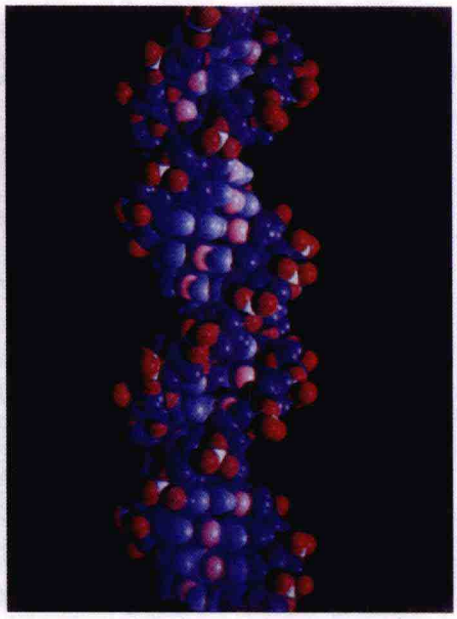


Fig. 0-12 The right figure is a double helix model of deoxyribonucleic acid. Deoxyribonucleic acid (DNA) is a principal substance in the nuclei of cells. It is the material base of storing and transmitting genetic information. In 1953, biologist J. D. Watson and physicist F. H. Crick successfully determined the double helix structure of DNA using the method of X-ray diffraction in the Cavendish laboratory.

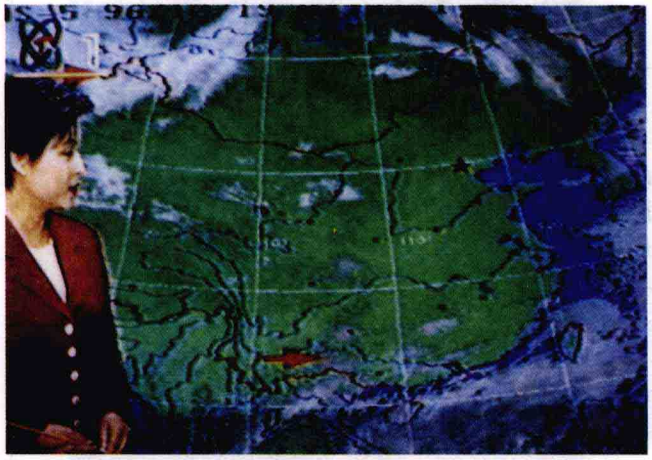


Fig. 0-13 Weather forecast. People carry out weather forecast by studying the nature and motion of the atmosphere with physics.

Physics is the key base of modern technology

The development of many high and new technologies, such as space technology, modern communication technology, laser technology, modern medical technology etc., cannot be separated from physics (Fig. 0-14).

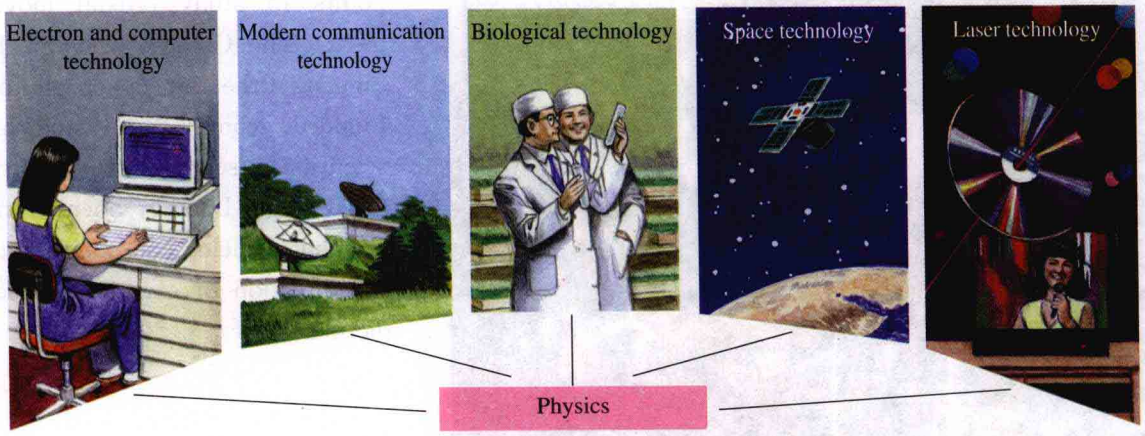


Fig. 0-14

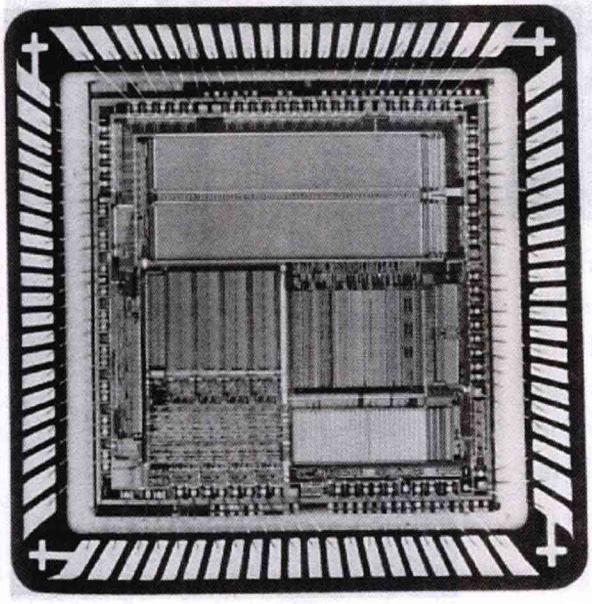


Fig. 0-15 The left figure is the heart of integrated circuits—semiconductor chip. Corpuscles composing substances obey quantum laws. Therefore, the production of a semiconductor cannot be separated from quantum mechanics. We may say, had it not been for quantum mechanics, there would not have been modern technology, nor modern life.

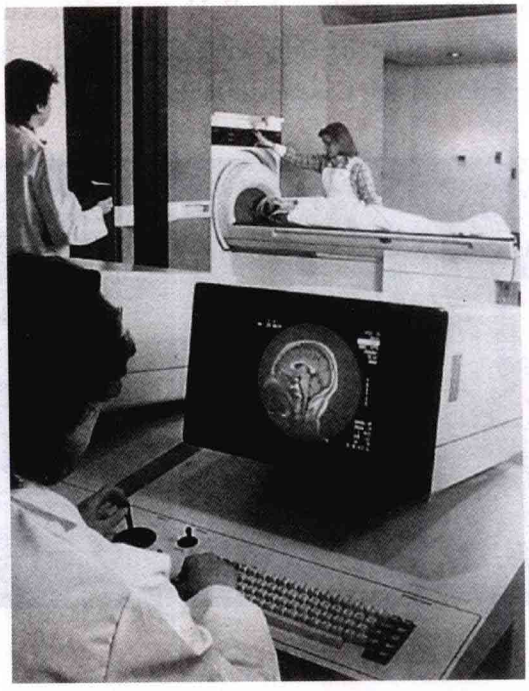


Fig. 0-16 The right figure shows a patient being examined with nuclear magnetic resonance imaging. The energy of a nuclei in a magnetic field forms several magnetic energy levels. When the frequency of the external magnetic Field, of high frequency, is in some special values, the nuclei takes the magnetic field energy and jumps to a higher magnetic energy level. This phenomenon is called nuclear magnetic resonance. Measuring the distribution of the resonance nuclei in human organisms by analyzing them with a computer, we can form an imagine of any section of human organs. And this possesses a very important significance in the diagnosis of tumor and disease of cerebral vessels.

Physics plays an important role in pushing forward the development of society

As a base of scientific technology, physics plays an important role in the development of human society. A lot of important technical inventions directly related to physics helped propel human society forward.

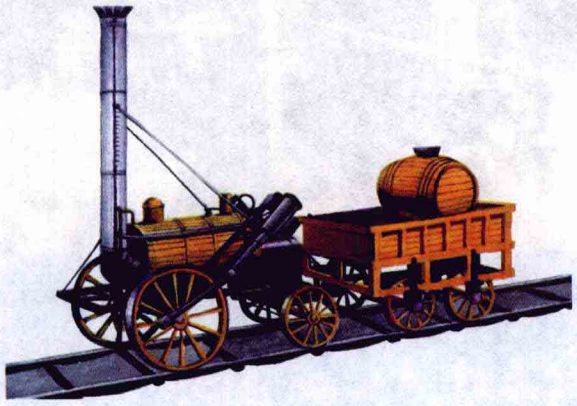
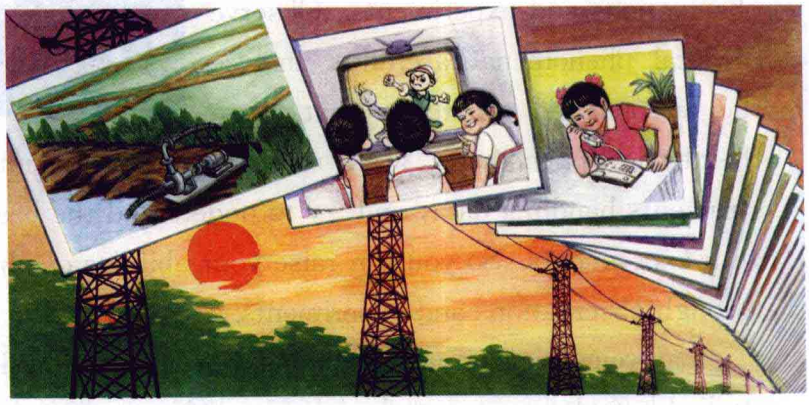


Fig. 0-17 This is the first steam locomotive in the history. In the middle of the 18th century, the contrivance of the steam locomotive benefited from the study of heat. The usage of the steam machine promoted the handicraft industry to change into great mechanize industry the spreading of big production to change, and made large-scale long distance conveyances on land and on sea both possible, and this consumedly pushed forward the development of society.

Fig. 0-18 The right figure shows the exploitation and application of electric energy. The exploitation and application of electricity developed on the base of the study of electromagnetics in the second half of the 19th century, has greatly affected the human's production and life and brought mankind to the electric era. Now, mankind cannot be separated from electricity.



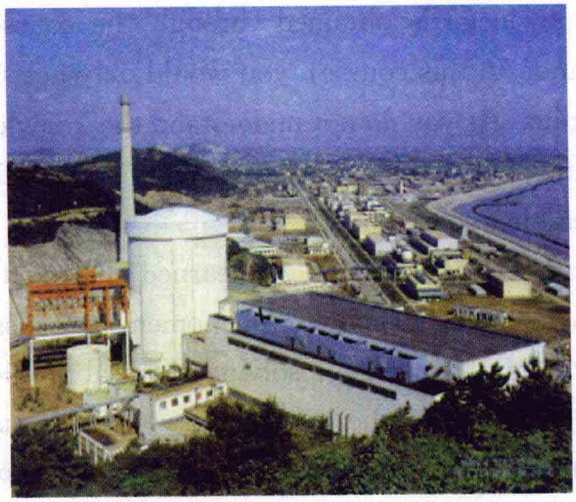


Fig. 0-19 Qinshan nuclear power station. The study of nuclear physics in this century has revealed to people a new energy —nuclear energy. The society of the mankind has already entered the nuclear time. At present, lots of countries have set up nuclear power stations. It is anticipated that at the end of this century, nuclear electricity will reach 30% of the gross electricity of the world.

How is it possible to master senior middle school physics

Having read the illustrations in the previous pages, you are sure to raise your aspirations and to delve into physics. Physics is one of the important subjects in senior middle school. It is very useful to master physics to enhance your scientific and cultural quality, adapt to the life of the modern society, and go on to the future advanced study.

How do you master senior middle school physics well?

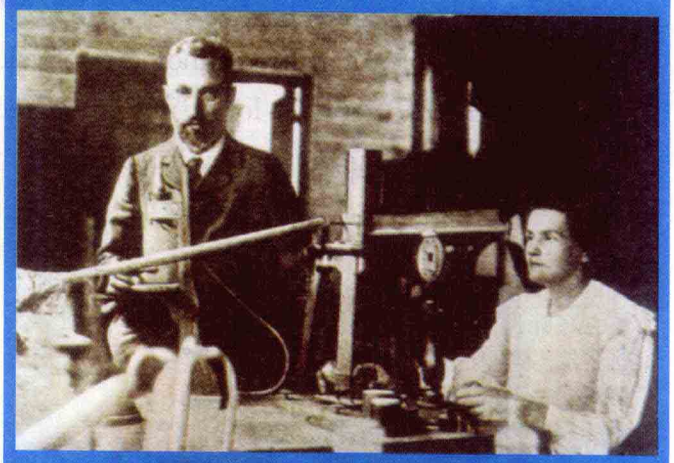


Fig. 0-20 Madame Curie (1867—1934) discovered the radioactive elements polonium and radium through hard experiments. Po is named after Madame Curie's motherland Poland. The discovery of radioactive elements opened the door of atomic nuclear world for the mankind. The photograph shows Madame Curie works with her husband in the laboratory.

Pay more attention to observations and experiments Knowledge of physics comes from practice, especially from observations and experiments. Observe physical phenomena carefully; analyze the reasons and conditions that cause the physical phenomena. Make experiments for students carefully, learn how to use instruments handling data, and try to understand the basic methods for solving problems with experiments. So you can raise your abilities of observation and doing experiments through observations and experiments.

Lay your stress on understanding To master physics, one needs to understand the studied knowledge accurately, clearly understanding the reasons for it. The knowledge of physics is obtained through abstraction and generalization based on the analysis of physical phenomena, or by inference. Knowledge is obtained through the course of scientific thinking. If you do not pay attention to this course, you would only get some dull formulas and clauses remain in your brain. As you do not understand the knowledge completely, you couldn't train your thinking ability. Lay your stress on understanding, and try to raise your ability of scientific thinking consciously.

Learn to use knowledge You should apply the knowledge you learned into practice. The scope of application is very extensive, including explaining phenomena, discussing problems, designing experiments, absorbing new knowledge, solving physical problems and so on. If you do not try to use your knowledge, the knowledge you get remains dead, not full-grown, and you cannot learn the methods of analyzing problems in application either. Try to expand and deepen your knowledge of application and learn to ana-

lyze a concrete problem in a specific way, so that you can raise your ability of analyzing and solving problems.

Do your exercises conscientiously Doing exercises is a step in learning physics, and it is an aspect of utilizing knowledge. When you solve a problem, be sure to understand it completely to make progress. Please remember the following quotation of the Chinese physicist Yan Jici.

"Doing exercises can deepen your comprehension, make you understand problems thoroughly, and train your ability of pondering and solving problems. If you cannot solve a problem, it means you do not understand it really yet. Even though you can solve all the problems, it is not necessarily to say that you have understood the problems completely, because, sometimes, when you do exercises, you only knock some formulas together. When you know where you understand and where you do not understand, you'll do your best to make it understood, then you can do fewer exercises."

CONTENTS