

T TRANSPARENCY ENCYCLOPEDIA PHYSICS

concepts and connections



drawings, models, charts, graphs, photographs, satellite imagery
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4 LIGHT ISBN 90-75967-24-1

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5 MATTER ISBN 90-75967-25-X

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Dear teacher(s)

Introduction

The Transparency Encyclopedia Physics is a collection of in total six files with 420 transparencies to illustrate the key issues in Physics education. Each file can be divided into two modules: one of 32 transparencies with the basics to teach students of 11 - 16 years, and one of 38 transparencies for the advanced levels.

Every transparency is designed to provide your students with immediate insight, a better understanding and a strong visual reminder. Artwork, photographs and diagrams have all been selected and designed for their timeless qualities and will provide a valuable resource for many years to come.

These powerful images will immediately catch your students' attention. To make the use even more simple and meaningful, we have added concise textual information for the teacher in small text on the transparency. When projected you can easily read it, together with questions which you might like to use.

When used by students themselves, working independently in groups, the very same textual information and questions will optimise their efforts. On every transparency is a reference to the page of the original DK publication as an extensive teacher's guide and as a rich resource in the classroom, in the library or for further study at home.

I hope you will enjoy using this unique teaching aid and I will be very interested to hear your comments and suggestions.

Yours

Drs. Jan Krol, Director TTE-Visual Transparencies To Educate

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1 Basics a1 Energy - Sound - waves Advanced

I ENERGY TRANSFORMATIONS

Basics

- 1 I-1 All energy comes from the sun (¶ 1-1) ^{B1.1}
- 1 I-2 Transforming the sun's energy (¶ 1-2) ^{B2.1}
- 1 I-3 Examples of energy transformations (▲ 1-1) ^{B3.1}
- 1 I-4 On jumping and falling (¶ 1-3) ^{B4.1}
- 1 I-5 Launching a rocket (▲ 1-2) ^{B5.12}

Advanced

- 1 I-6 Kinetic and potential energy
- 1 I-7 Energy diagram of a roller-coaster

II ELECTRICAL ENERGY - FOSSIL ENERGY

Basics

- 1 II-1 Generating electricity (▲ 1-3) ^{B3.1}
- 1 II-2 A coal-based power station (¶ 2-1) ^{B2.1}
- 1 II-3 Natural gas: formation and extraction (¶ 2-2) ^{B1.1}

Advanced

- 1 II-4 • Little energy from the sun reaches earth .₀
- 1 II-5 • Our sources of energy .₀
- 1 II-6 • Use of energy until 2060 .₀

III SUSTAINABLE ENERGY

Basics

- 1 III-1 A hydroelectric power station (▲ 1-4) ^{B1.34}

Advanced

- 1 III-2 • Energy from Sun and Earth .₁₃
- 1 III-3 • Solar cells .₁
- 1 III-4 Solar energy
- 1 III-5 Wind energy

IV ENERGY TRANSFORMATIONS IN MACHINES

Basics

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- 1 IV-2 Energy and efficiency: you can't have it all! (▲ 2-1) ^{B2.34}

Advanced:

- 1 IV-3 • Internal combustion engine .₁

V HEAT: TRANSPORT AND INSULATION

Basics

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- 1 V-2 Temperature and heat transport (¶ 3-1) ^{B2.34}
- 1 V-3 Insulation: preventing heat transport (¶ 3-2) ^{B3.34}
- 1 V-4 Central heating (¶ 3-3) ^{B4.34}

Advanced

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- 1 V-6 • Cooling down .₁
- 1 V-7 • Fridge and airco: absorbing heat via evaporation .₇₈

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Basics

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- 1 VI-2 Sleeping or walking (▲ 2-3) ^{B2.3}
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Advanced

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- 1 VI-5 • Energy use in different countries .₁₂

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Basics

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- 1 VII-2 Discovering energy 1800 – 1900 (▲ 3-2) ^{B2.34}
- 1 VII-3 Discovering energy 1900 – today (▲ 3-3) ^{B3.34}

Advanced

- 1 VII-4 • "The ultimate law of nature" - 2nd law of thermodynamics .₁
- 1 VII-5 • Conservation of energy - 1st law of thermodynamics .₁
- 1 VII-6 • Handy: Conversion table metric - imperial

VIII SOUND: FROM SOURCE TO EAR

Basics

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- 1 VIII-2 Waves through air and water (▲ 4-1) ^{B1.45}
- 1 VIII-3 The miraculous ear can hear (¶ 4-2) ^{B3.1}

Advanced

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- 1 VIII-5 Doppler effect
- 1 VIII-6 Shock waves: special case of the Doppler effect

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Basics

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- 1 IX-2 Sound volume: decibel scale (¶ 4-3) ^{B1.1}
- 1 IX-3 Timbre or tone: the quality of sound (▲ 4-3) ^{B3.1}

Advanced

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- 1 IX-5 • Resonance 2: From bath tube to microwave .₀

X SOUND RECORDING

Basics

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- 1 X-2 Analogue recording: tapes and records (▲ 4-4) ^{B2.1}

Advanced

- 1 X-3 • Digital sound .₁
- 1 X-4 • CD burning and playing .₁₄

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Basics

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Advanced

- 1 XI-3 • Ultrasound - ships' sonar .₃₄
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Basics

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Advanced

- 1 XII-2 Harmonic waves travelling along a rope
- 1 XII-3 Element of mass on a rope has KE as a wave pulse passes
- 1 XII-4 Reflection of a wave from fixed & free boundaries
- 1 XII-5 Superposition of wave pulses
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- 1 XII-7 Superposition of sound waves
- 1 XII-8 Hooke's law
- 1 XII-9 Simple harmonic motion
- 1 XII-10 Harmonic oscillator displacement curves
- 1 XII-11 Curves for variation in k, m and x
- 1 XII-12 Simple pendulum

2 Basics a2 Advanced Electricity - electromagnetism

I CHARGED PARTICLES

Basics

- 2 I-1 Static electricity: attraction and repulsion s (¶ 5-1) 81.1
- 2 I-2 Electrostatic induction: attracting the uncharged (▲ 5-2) 82.18
- 2 I-3 Lightning: discharging in a flash (¶ 5-2) 83.18

Advanced

- 2 I-4 Charging an electroscope by induction
- 2 I-5 Van de Graaff's generator
- 2 I-6 Superposition of electric forces
- 2 I-7 Superposition of electric fields
- 2 I-8 Electric flux

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Basics

- 2 II-1 Batteries (¶ 6-1) 81.1
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Advanced

- 2 II-5 • Measuring electricity from light .1

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Basics

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- 2 III-2 Simple electrical circuits (¶ 7-2) 83.18
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Advanced

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- 2 III-6 Grounded, short and open circuits
- 2 III-7 Electric potential across conductor causes current
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Basics

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Advanced

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Basics

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- 2 V-2 Bimetallic switches: reacting to temperature (¶ 7-5) 85.14
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Advanced

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Basics

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Advanced

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Advanced

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- 2 VII-3 Electric field lines: two unlike charges

- 2 VII-4 Electric field lines: two like charges
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- 2 VII-7 Equipotential line: point charge
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- 2 VII-9 Gaussian surfaces around point charges

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Basics

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Advanced

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- 2 VIII-4 Capacitors connected in parallel
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Basics

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Advanced

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- 2 IX-7 Direction of magnetic dipole moment of current loop

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Basics

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- 2 X-2 Electromagnet: magnetism from electricity 1 (¶ 8-3) 81.10

Advanced

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Basics

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Advanced

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3 Basics b1 Advanced Mechanics

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Basics

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Basics

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Advanced

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Advanced

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- 3 IX-1 Forces on hammer throwing - centripetal force (▲ 11-5) 81,1

Advanced

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Basics

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Basics

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Advanced

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4 Basics b2 Advanced Light - optics

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Basics

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Advanced

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Advanced

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Advanced

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- 4 XII-8 Single slit diffraction pattern geometry

- 4 XII-9 Intensity of double split pattern

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0 The set up of a TTE transparency

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Basics

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- 5 I-2 Water in the kitchen (▲ 17-1) ^{82,1}
- 5 I-3 Distillation: evaporating and condensing (¶ 17-2) ^{83,34}

Advanced

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Advanced

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Advanced

- 5 V-2 Boyle's law: volume of a gas in relation to pressure
- 5 V-3 Gay-Lussac's law: volume of a gas in relation to temperature
- 5 V-4 Carnot engine: converting heat into work
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- 5 VI-4 Wind speed: Beaufort's scale (¶ 18-4) ^{81,1}

Advanced

- 5 VI-5 • Atmosphere - a cross-section .1
- 5 VI-6 Pressure and altitude

VII MEASURING TECHNIQUES

Basics

- 5 VII-1 Measuring weight and mass (¶ 19-1) ^{81,45}
- 5 VII-2 Measuring volume and upthrust (¶ 19-2) ^{82,34}
- 5 VII-3 Converting units of volume (¶ 19-3) ^{83,1}
- 5 VII-4 Measuring density (▲ 20-4) ^{84,1}
- 5 VII-5 Gas burners (¶ 19-4) ^{85,1}

Advanced

- 5 VII-6 • Estimating exercises .1
- 5 VII-7 International Units SI
- 5 VII-8 Conic sections
see also: 1 VII-6 Conversions metric - imperial

VIII DISCOVERING MATTER

Basics

- 5 VIII-1 Discovering radio-activity (▲ 19-2) ^{81,1}

Advanced

- 5 VIII-2 • Discovering matter until 1850 .1
- 5 VIII-3 • Discovering matter since 1850 .1
- 5 VIII-4 • History of models for matter .1,12
- 5 VIII-5 • Discovery of electron and nucleus .1
- 5 VIII-6 Millikan's oil drop experiment (XXVIII-2)

IX RADIOACTIVITY

Basics

- 5 IX-1 Alpha, beta and gamma radiation (▲ 19-1) ^{81,1}
- 5 IX-2 Medical applications of radioactivity (¶ 20-2) ^{83,1}
- 5 IX-3 Carbon dating method (▲ 19-3) ^{82,34}

Advanced

- 5 IX-4 • Radioactive decay .1,4

X SUBATOMIC PARTICLES

Basics

- 5 X-1 From drip to quark, a dive into the atom (▲ 20-1) ^{81,34}

Advanced

- 5 X-2 • Quarks and Hadrons .1
- 5 X-3 • Big accelerator .1
- 5 X-4 • Elementary particles, strange particles .0
- 5 X-5 The Geiger and Marsden experiment
- 5 X-6 Particle detection in a cloud and bubble chamber 1
- 5 X-7 Particle detection in a cloud and bubble chamber 2

XI APPLICATION OF IONISING RADIATION

Basics

- 5 XI-1 Medical applications of X-rays (▲ 19-4) ^{81,34}
- 5 XI-2 X-rays at the airport (¶ 20-3) ^{82,1}

Advanced

- 5 XI-3 • View in the human body: NMR .1
- 5 XI-4 • View in the human body: PET-scan .1
- 5 XI-5 Contribution of various radiation sources
- 5 XI-6 Bragg scattering of X-rays from a crystal

XII NUCLEAR ENERGY

Basics

- 5 XII-1 $E=mc^2$ - discovering nuclear energy (¶ 20-1) ^{81,1}
- 5 XII-2 Nuclear reactions: mankind's blessing or curse? (▲ 20-2) ^{82,1}
- 5 XII-3 Nuclear power station (▲ 20-3) ^{83,1}

Advanced

- 5 XII-4 Chain reaction
- 5 XII-5 Fission power plant
- 5 XII-6 Sun energy, fusion

a. Basics 192 transparencies for the lower forms.

b. Advanced 258 transparencies for the higher forms. If coded with a dot (•) this is one of the 87 DK based transparencies, which can also be used for the lower forms.

6 Basics c2 Advanced Electronics - Universe

I POWERS OF TEN

Basics

- 6 I-1 With giant steps to the end of space (¶ 22-1) ^{§1,1}
- 6 I-2 To the tiniest in the microcosmos (▲ 21-1) ^{§2,3,4}

Advanced

- 6 I-3 • Universe linked with elementary particles .1
- 6 I-4 Relative size
- 6 I-5 • Powers of ten in symbols and numbers .0

II COMMUNICATION TECHNIQUES

Basics

- 6 II-1 Modern navigation techniques (¶ 21-1) ^{§1,1}
- 6 II-2 Global communication: radio and television (¶ 21-2) ^{§2,1}
- 6 II-3 Telephone: how distance speech shrunk the world (▲ 21-2) ^{§3,1}
- 6 II-4 World Wide Web: the world one village? (¶ 21-3) ^{§4,1}

Advanced

- 6 II-5 • Communication technology in society .1
- 6 II-6 • Telephones: from morse to videophone .1
- 6 II-7 • TV: electromagnetic waves become colours .1

III MICRO ELECTRONICS

Basics

- 6 III-1 Calculators: complex calculations at the touch of a key (¶ 21-4) ^{§1,1}
- 6 III-2 Computer components - input and output devices (▲ 21-4) ^{§2,1}
- 6 III-3 Opto-electronics (▲ 21-3) ^{§3,1}

Advanced

- 6 III-4 • Transistor and LDR .1
- 6 III-5 • Semi-conductors: diode and LED .1
- 6 III-6 • Chips and memory .1
- 6 III-7 • Adder .2,3
- 6 III-8 • Using chips .1

IV RELATIVITY

Basics

- 6 IV-1 Foucault's pendulum (▲ 22-3) ^{§1,1,3}

Advanced

- 6 IV-2 Range of applicability of Newton's laws
- 6 IV-3 Events simultaneous or not?
- 6 IV-4 Time dilatation derivation
- 6 IV-5 Mass and energy in special relativity
- 6 IV-6 Length contraction derivation

V QUANTUM PHYSICS

Basics

- 6 V-1 Light: particles or waves? (▲ 21-5) ^{§1,1}

Advanced

- 6 V-2 Electron orbits in Bohr's model of hydrogen
- 6 V-3 De Broglie's waves: atomic electron waves
- 6 V-4 Photoelectric effect apparatus
- 6 V-5 Diffraction pattern from single particle events
- 6 V-6 Uncertainty principle
- 6 V-7 Compton scattering of an X-ray photon
- 6 V-8 Quantum mechanical tunnelling

VI SATELLITES

Basics

- 6 VI-1 Weightless in a satellite (¶ 22-2) ^{§1,1}
- 6 VI-2 Gravity: enabling satellites (¶ 22-3) ^{§2,1}
- 6 VI-3 Satellites for communication and navigation (¶ 22-4) ^{§3,1}
- 6 VI-4 The space shuttle: recycling rocket (▲ 22-4) ^{§1,1}

Advanced

- 6 VI-5 • High and low satellite orbits .1
- 6 VI-6 Men in space

VII SUN, MOON AND EARTH

Basics

- 6 VII-1 Earth, the blue planet (¶ 23-3) ^{§5,1}
- 6 VII-2 Midsummer night in polar regions (¶ 23-2) ^{§2,3}
- 6 VII-3 The moon: the earth's first satellite (¶ 23-4) ^{§3,3,3}
- 6 VII-4 Tidal waves caused by gravity (▲ 22-2) ^{§4,3,4}
- 6 VII-5 The sun, our nearest star (¶ 23-1) ^{§1,3}

Advanced

- 6 VII-6 • Birth of the Earth .1
- 6 VII-7 Eclipse of sun and moon

VIII THE SOLAR SYSTEM

Basics

- 6 VIII-1 17th Century planetarium (▲ 22-1) ^{§1,7,8}
- 6 VIII-2 Comets: regular visitors (¶ 24-2) ^{§2,1,2}
- 6 VIII-3 Surface of the moon (¶ 24-3) ^{§3,1,2}

Advanced

- 6 VIII-4 • Travelling through the solar system: cosmic snooker .1
- 6 VIII-5 Solar system
- 6 VIII-6 Gravitational potential energy far away from earth
- 6 VIII-7 Potential energy - distance from the earth's centre

IX THE STARS

Basics

- 6 IX-1 Starry sky - northern hemisphere and Zodiac signs (¶ 24-4) ^{§2,1}
- 6 IX-2 Starry sky - southern hemisphere and star watching (▲ 24-4) ^{§3,1,8}
- 6 IX-3 The Sun in our Milky Way (▲ 23-1) ^{§1,1}

Advanced

- 6 IX-4 • Lifecycle of stars .1
- 6 IX-5 Supernova of 1752
- 6 IX-6 Spiral Galaxy, Milky Way and Jupiter

X ORIGIN OF THE UNIVERSE

Basics

- 6 X-1 From Big Bang to homo sapiens (¶ 24-1) ^{§1,1,8}
- 6 X-2 The expanding universe (▲ 23-2) ^{§2,1}

Advanced

- 6 X-3 • Big Bang, elements and evolution of life .1
- 6 X-4 • Big Bang, via particles to a cold death .0
- 6 X-5 • Scientific speculations and beyond: the future of the universe .1
- 6 X-6 • Doppler effect and the expanding universe - Red Shift .1

XI ASTROPHYSICS

Basics

- 6 XI-1 Dying stars: creating white dwarfs, neutron stars or black holes (▲ 23-3) ^{§1,1}

Advanced

- 6 XI-2 • Einstein's gravity, cosmic lenses and space-time .1
- 6 XI-3 • Black holes and spaghettification .1,2

XII DISCOVERING EARTH AND UNIVERSE

Basics

- 6 XII-1 Discovering Earth and Universe up to 1850 (▲ 24-1) ^{§1,1}
- 6 XII-2 Discovering Earth and Universe 1850 – now (▲ 24-2) ^{§2,1}
- 6 XII-3 Star watching in ancient times (▲ 24-3) ^{§3,1}

Advanced

- 6 XII-4 • Famous scientists: portrait gallery .1
- 6 XII-5 • Galileo's telescope - parallax .1,2

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