

PHYSICS 534

EXERCISE-01

Intro to Physics



Wilhelm Roentgen received the first ever Nobel prize for physics in 1901 for his work on X-rays.

ROENTGEN

PHYSICS is the study of energy and consists of five main branches each studies a different form of energy:

- **Mechanics** (The study of forces or work; work is a form of energy)
- **Thermodynamics** (The study of heat; heat is a form of energy)
- **Acoustics** (The study of sound; sound is a form of energy)
- **Optics** (The study of light; light is a form of energy)
- **Electricity and magnetism** (Both are forms of energy)

Just as there are different forms of money (the nickel, the dime, the quarter, the "five-dollar" bill, the check, etc.), there are different forms of energy (heat, sound, light, electricity, etc.). Each different form is a different branch of physics. And, just as one form of money can be converted into a different form of money, likewise one form of energy can be converted into a different form of energy. Even matter is just a form of energy ($E = mc^2$).

The device used to convert one form of energy into another form of energy is called a **TRANSDUCER**.

Some popular transducers include:

- The light bulb (which converts electrical energy into light energy)
- The electric motor (which converts electrical energy into mechanical energy)
- The electric heater (which converts electrical energy into heat energy)
- The generator (which converts mechanical energy into electrical energy)
- The speaker (which converts electrical energy into sound energy)
- The microphone (which converts sound energy into electrical energy)
- The photocell (which converts light energy into electrical energy)

The efficiency of a transducer tells us how well it converts one type of energy into another type of energy. For example, a car motor is about 25% efficient, an electric motor is about 80% efficient, etc. One of the laws of energy states that transducers **can never** be 100% efficient (not today, not tomorrow, never! It's a **law of nature!**).

HISTORICAL NOTE

Physicists reduced the entire universe into matter and energy and things remained that way until 1905 when Einstein unified them with his famous formula $E = mc^2$. Static electricity and magnetism didn't fit into the mechanical picture and, because of their limited practical uses, were not considered as being part of science. Neither did light fit into the mechanical universe. Meaningful understanding of electricity and light had to wait for the invention of the battery by Alessandro Volta in 1800 and the optical experiments by Thomas Young and Augustin Fresnel in 1801.

1. Define physics:

The study of energy.



2. State and define the five branches of physics:

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|---|-----------------------|--|
| ① | Mechanics | The study of forces and their effects. |
| ② | Thermodynamics | The study of heat. |
| ③ | Acoustics | The study of sound. |
| ④ | Optics | The study of light. |
| ⑤ | Electricity | The study of electricity and magnetism. |

3. Define a "transducer":

A device which transforms one form of energy into a different form of energy.

4. List any three transducers (include the type of energy converted):

Light bulb: Converts electrical energy into light energy.

Solar cell: Converts light energy into electrical energy.

Motor: Converts electrical energy into mechanical energy.

5. Is it possible for a transducer to be 100% efficient? No Explain:

Because it is impossible to convert one form of energy completely (100%) into just one other form. When energy is converted from one form to another, we always get two or more different forms of energy. For example, a light bulb gives us light and heat. As a result, perpetual motion is impossible.

6. State the five steps of the "scientific method":

- ① **Observation**
- ② **Hypothesis**
- ③ **Experimentation**
- ④ **Theorization**
- ⑤ **Communication**

7. State the difference between the two types of observations:

Qualitative: A description in words.

Quantitative: A measurement (number).

8. State the difference between an "hypothesis" and a "law" of nature.

A hypothesis is an initial guess which needs to be verified.

A law has been proven over a period of time.

9. What happens to a theory when new observations are made that the theory **cannot** explain?:

The theory is modified or replaced.

10. Is science "absolute"? Explain:

No, science is based only on the currently known facts whose

theories are modified or replaced as new facts are known.

