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باسمه تعالی

نام درس: متون تخصصی فیزیک

تعداد واحد: ۲

نام منبع: English for Physics Students

نام مولف: دکتر منوچهر جعفری گهر

نام تهیه کننده: دکتر منوچهر جعفری گهر

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۲- مرور نکات پربسامد دستوری، واژگانی، تلفظی و معنایی با اشاره به خط مربوطه

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- ۳- متن های مشابه را با سرعت و سطح درک مناسب بخوانند.
- ۴- متن های کوتاه انگلیسی را به فارسی برگردانند.
- ۵- انواع کلمه انگلیسی را از هم تشخیص دهند.

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دانشجویان فیزیک می بایست بتوانند به منظور اطلاع و بهره گیری از آخرین تحولات علمی در سطح کارشناسی و همچنین در دوره های تحصیلات تکمیلی از منابع معتبر به زبان انگلیسی استفاده کنند. از اینرو درس زبان تخصصی از جایگاه ویژه ای در برنامه درسی مقطع کارشناسی فیزیک برخوردار است.

# UNIT ONE

## What is Physics?

### Key Words

- ❖ Centrifuge
- ❖ Electron microscope
- ❖ Molecule
- ❖ Mechanics
- ❖ Nuclear
- ❖ Physicist

# General Words

- ❖ Application
- ❖ Approach
- ❖ Concept
- ❖ Deductive
- ❖ Instrumentation
- ❖ Significance
- ❖ Subfield

## The structure of passive (line 7)

- ❖ They give no clue as to why some subfields are included and others are not.
- ❖ Object + be + Past participle
- ❖ The car was stolen.



The use of the second verb in –ing form (line 20)

❖ This is because physicists sometimes gradually abandon a field ... (*and they leave*) leaving further developments and practical applications to others.

# Words and expressions that show similarity between two sentences (line 28)

- ❖ Also
- ❖ Besides
- ❖ Similarly
- ❖ In addition to
- ❖ Furthermore
- ❖ As a matter of fact

## Shortened relative clause (line 36)

- ❖ The physical laws (*that govern*) governing the behavior of molecules, atoms, and the atomic nuclei are the ...

The use of “colon” to introduce a list (line 39)

❖ Physiology offers many examples of physical processes and principles: diffusion within cells, the regulation of the body temperature, the motion of fluids ...

**“it” that is used to fill subject position (line 53)**

**❖ I bough a book. I will read it tomorrow.**

**❖ It is necessary for you to go.**

**❖ It is obligatory to obey the rules.**

# Comprehension Review

1. The definition “physics is the branch of science that deals with matter, energy and their interactions” is accepted by the writer. F

# Comprehension Review

2. We can find a suitable definition for physics in larger dictionaries. F

3. Physics is concerned with the basic rules that govern the operation of nature. T

# Comprehension Review

4. The modern developments in physics might help a philosopher to have a deeper understanding of space and time. T



# Comprehension Review

5. How body controls its temperature is studied by biochemists. F

6. The most important step to master physics is to learn its basic ideas. T

**Answer the following questions  
in Farsi**

- 1. What is the problem with a short dictionary definition?**
- 2. Why may scientists abandon a field of science?**

**Answer the following question  
in Farsi**

**3. What is the role of physics  
knowledge in the use of  
different instruments?**

# Vocabulary Review

❖ Would you please -----  
on your plan; I need more details  
to make a decision.

a. elaborate ←

b. elaboration

c. elaborately

d. elaborating

# Vocabulary Review

❖ The ----- of modern vehicles has damaged the natural environment of the earth.

a. evolve

b. evolved

c. evolution ←

d. evolutionary

# Vocabulary Review

❖ The surgeon gave an -----  
description of the patient's leg  
before the operation.

- a. anatomically      b. anatomical ←
- c. anatomy            d. anatomist

# Vocabulary Review

❖ A thermostat can -----  
the flow of hot water in a  
car's cooling system.

a. regulation

b. regulator

c. regulatory

d. regulate ←

# Vocabulary Review

❖ The 20<sup>th</sup> century has brought great advances in all fields of science.

a. developments ←

b. statements

c. Evolutions

d. regulations



# Vocabulary Review

❖ Steven Hawking, who was born in 1942, is a contemporary physicist.

a. atomic

b. modern ←

c. centrifugal

d. conceptual

# Vocabulary Review

❖ Most of the scientific discoveries have practical significance for man's life.

a. complication

b. elaboration

c. equivalence

d. importance ←

# Vocabulary Review

❖ He has never been concerned about what others think of him.

a. accurate

b. worried ←

c. determined

d. discerning

# Vocabulary Review

❖ The invention of radar systems has made the ----- of flying objects possible.

- a. detection ←      b. derivation  
c. conservation      d. application

# Vocabulary Review

❖ The ----- framework of the theory of relativity is complicated.

a. conceptual ←

b. contradictory

c. evolutionary

d. artificial

# Vocabulary Review

❖ We usually need the help of a good teacher to understand ----- physics problems.

- a. complicated ← b. derived  
c. comparable d. negligible

# Vocabulary Review

❖ The computer has made an important ----- on different aspects of modern life.

a. advance

c. credit

b. impact ←

d. quantity

# Vocabulary Review

❖ Physical optics is an interesting ----- of the science of physics.

a. concept

b. analysis

c. subfield ←

d. facet



# Vocabulary Review

❖ Technologists are concerned with the practical ----- of scientific findings.

a. detection

b. derivation

c. conservation

d. application ←

# UNIT TWO

## The Relation of Physics to other Sciences

### Key Words

- ❖ Conservation of energy
- ❖ Discharge
- ❖ Density
- ❖ Ion
- ❖ Pitch
- ❖ Timbre

# General Words

- ❖ Biology
- ❖ Compound
- ❖ Inorganic chemistry
- ❖ Membrane
- ❖ Meteorology
- ❖ Periodic chart

## Explanation after comma (line 9)

- ❖ ... the early days of chemistry dealt almost entirely with what we now call inorganic chemistry, the chemistry of substances which are not ...

## Frequent use of passives in technical texts (line 16)

- ❖ ... because the theory of atoms was substantiated to a large extent by experiments in chemistry.

# The structure of passive sentences

- ❖ Edison invented the telegraph.
- ❖ The telegraph was invented by Edison.
- ❖ Object + be + P.P. + by-subject

**“it” is not translated in some sentences (line 30)**

**❖ It takes some effort to get into the finer details.**

**❖ It is five o'clock.**

**❖ It is cold today.**

## Three types of conditional sentences (line 37)

- ❖ If you come, you will see me.
- ❖ If you came, you would see me.
- ❖ If you had come, you would have seen me.



## Backward and forward reference of pronouns (line 42)

❖ The students were reading their books.

❖ In their study of nerves, the biologists have come to the conclusion that...

# Comprehension Review

1. Other fields of science have been affected by physics. T
2. Long ago, physics did NOT exist separately; it was part of natural philosophy. T

# Comprehension Review

3. First chemists mainly studied organic chemistry. F

4. Ions can move freely only inside the nerve cells. F

# Comprehension Review

5. All atoms emit lights which have the same frequency. **F**
6. A stectroscope is used to discover new chemical elements on stars. **T**

# Comprehension Review

7. Technetium was first discovered on earth. F

8. Geology is also called an earth science. T

9. Scientists have developed a good theory of meteorology. F

# **Answer the following questions in Farsi**

- 1. What are the main relationships  
between physics and biology?**
- 2. What is known about the inside  
of the earth?**

**Answer the following question  
in Farsi**

**3. What is the difference  
between organic and  
inorganic chemistry?**

# Vocabulary Review

❖ They gave us a -----  
of the machine to show how  
it worked.

a. demonstrate

b. demonstration ←

c. demonstrative

d. demonstratively



# Vocabulary Review

❖ His discoveries had a strong -----on the world of science.

- a. impress      b. impression ←
- c. impressive    d. impressively

# Vocabulary Review

❖ After some experiments, the physicist ----- that his theory had to be corrected.

- a. discerned ←      b. discernment  
c. discerning      d. discernible

# Vocabulary Review

❖ The manufacture of cars is a long and difficult process.

a. motion

b. reaction

c. production ←

d. rotation

# Vocabulary Review

❖ An important project cannot proceed without the help of many experts.

a. collapse

b. circulate

c. succeed

d. continue ←

# Vocabulary Review

❖ The invention of computers had a profound effect on scientific developments.

a. dense

c. finite

b. deep ←

d. crude

# Vocabulary Review

❖ As he could not -----  
the solution to the problem,  
he decided to ask for my  
help.

a. slow down

b. make up

c. figure out ←

d. bring out

# Vocabulary Review

❖ The Einstein's theory of relativity has been ----- by many recent experiments.

a. substantiated ←

b. reciprocated

c. postulated

d. circulated

# Vocabulary Review

❖ Lightning is caused when clouds ----- electricity.

a. conquer

b. conserve

c. excite

d. discharge ←



# Vocabulary Review

❖ Heavier elements usually have a higher ----- than lighter ones.

- a. density ←      b. energy  
c. magnitude      d. momentum

# Vocabulary Review

❖ Energy can be changed into different forms, but it is never created or destroyed. This is called the principle of ----- of energy.

- a. conservation ← b. oscillation  
c. quantity            d. discharge

# Vocabulary Review

❖ Sulphur dioxide is a -----  
made from sulphur and oxygen.

a. condition

b. content

c. component

d. compound ←

# Vocabulary Review

❖ Alcohol can easily -----  
into gas when it is placed in  
open space.

a. concentrate

b. derive

c. circulate

d. convert ←

# Vocabulary Review

❖ The police is investigating his death because he died in strange ----- .

a. circumstances 

b. properties

c. Scales

d. masses

# UNIT THREE

## Physics and its System of Measurement

### Key Words

- ❖ Alloy
- ❖ Derived quantity
- ❖ Fundamental quantity
- ❖ Oscillation
- ❖ Quantity
- ❖ vacuum

# General Words

❖ Component

❖ Equator

❖ Objective

❖ Potential

❖ Subjective

❖ Verify

# Words and expressions that show contrast or difference between sentences (line 6)

- ❖ But/Yet
- ❖ On the other hand
- ❖ On the contrary
- ❖ Nevertheless
- ❖ However
- ❖ In spite of



## Review of modal verbs (line 9)

**Ability:** He can run very fast.

**Possibility:** It may/might rain tonight.

**Permission:** The student can/may leave the classroom.

## Review of modal verbs (line 9)

**Suggestion/advice:** You should be more careful.

**Obligation:** People must obey the law.

# Changing verbs into nouns (line 16)

- ❖ Occur + ence = occurrence
- ❖ Derive + tion = derivation
- ❖ Discern + ment = discernment
- ❖ Suspend + sion = suspension
- ❖ Behave + or = behavior

# Deletion of words in parallel sentences (line 17)

- ❖ Physical principles help explain the rocket, *(physical principles help explain)* why a tennis ball may curve, how a refrigerator works, and...

# Changing nouns into adjectives (line 36)

- ❖ Experiment + al = experimental
- ❖ Danger + ous = dangerous
- ❖ Quantity + ative = quantitative
- ❖ History + ical = historical
- ❖ Atom + ic = atomic
- ❖ Evolution + ary = evolutionary

# Comprehension Review

1. Matter and energy have effects on each other. T
2. Experiment and observation play important roles both in physics and in science in general. T

# Comprehension Review

3. Scientists may decide to repeat an experiment conducted by other scientists. T
4. Different scientists use words with exactly the same meaning. F

# Comprehension Review

5. Physical properties that can be measured are called physical quantities. T

6. Some quantities are made up of other quantities. T



# Comprehension Review

7. The new unit of length is based on the speed of light.  $\tau$

**Answer the following questions  
in Farsi**

- 1. Why is objectivity important  
and how is it achieved?**
- 2. What are the properties of a  
useful fundamental standard?**

**Answer the following question  
in Farsi**

**3. How do modern scientists  
define meter and second?**

# Vocabulary Review

❖ At present, it is impossible to  
----- the total damage  
caused by the flood yesterday.

- a. quantify ←      b. quantity  
c. quantitative      d. quantitatively

# Vocabulary Review

❖ He has been very kind to me and he expects the ----- of his favors by me.

a. reciprocate

b. reciprocal

c. reciprocation ←

d. reciprocally

# Vocabulary Review

❖ Thousands of English words  
----- from Latin, Greek and  
some other languages.

a. derive ←  
c. derivative

b. deriving  
d. derivation

# Vocabulary Review

❖ The estimate of the costs is very crude. It does not include all the expenses.

a. massive

b. equal

c. rough ←

d. dense

# Vocabulary Review

❖ In order to solve a problem, we should consider its different facets.

a. masses

c. motions

b. aspects ←

d. fractions



# Vocabulary Review

❖ A student's success hinges on many factors including intelligence, motivation and interest.

a. deals

b. conforms

c. steps

d. depends ←

# Vocabulary Review

❖ A sudden increase in the quantity of production may damage the quality.

a. amount ←

c. substance

b. matter

d. state

# Vocabulary Review

❖ Light can travel tens of thousands of kilometers in a (n) ----- of a second.

- a. initiation      b. migration  
c. obligation      d. fraction ←

# Vocabulary Review

❖ If you create -----  
inside a container, the air  
pressure outside will crush  
its walls.

a. balance

c. motion

b. vacuum ←

d. density

# Vocabulary Review

❖ Brass is not a simple metal.  
It is a (n) ----- which is a  
mixture of copper and zink.

a. solution

b. position

c. alloy ←

d. bond

# Vocabulary Review

❖ We can find out the -----  
between a flash of lightning  
and the sound of thunder to  
find out the height of the  
cloud.

a. interplay

b. interval ←

c. interference

d. interface

# Vocabulary Review

❖ His favorite ----- was physics, but he had to study medicine because his father asked him to.

a. course

b. element

c. lesson

d. major ←

# Vocabulary Review

❖ To measure the minerals of a lake, scientists test a ----- amount of its water. They need not test the whole water.

a. representative ←

b. derivative

c. deductive

d. massive



# Vocabulary Review

❖ Some instruments can measure the ----- of radio waves.

- a. oscillation ← b. domination  
c. reciprocation d. connection

# Vocabulary Review

❖ ----- quantity which is also known as base quantity, is measured by means of physical standard.

a. Molecular

b. Conceptual

c. Fundamental ←

d. Centrifugal

# UNIT FOUR

## Newton's Laws of Motion

### Part One

### Key Words

- ❖ Acceleration
- ❖ Equilibrium
- ❖ Friction
- ❖ Gravity
- ❖ Inertia
- ❖ Motion

# General Words

- ❖ Astronomy
- ❖ Biomechanics
- ❖ Macroscopic
- ❖ Phenomenon
- ❖ Net
- ❖ State

## Some uses of "as" (line 4)

- ❖ This car is the same as that one.
- ❖ Ali is as tall as John.
- ❖ He works as a physicist.
- ❖ He came as I was leaving.

# Words and expressions that show result (line 11)

- ❖ So
- ❖ Thus
- ❖ Therefore
- ❖ Consequently
- ❖ As a result
- ❖ As a consequence

## Frequent use of relative clauses in technical texts (line 16)

❖ Thus, a wagon (that was)  
*detached from the horse*  
*that was pulling it* would  
quickly come to rest because

...

Relative pronoun may be object or subject of the clause

❖ **Subject:**

The boy who (*or that*) came is tall.

❖ **Object:**

The boy whom (*or that*) you saw is tall.



## Two ways of using sensory verbs (line 33)

❖ see, smell, watch, feel

❖ I saw him cross the street.

❖ I saw him crossing the street.

# The order of adverbs of frequency (line 43)

❖ Always	100
❖ Usually	.
❖ Often	.
❖ Sometimes	.
❖ Seldom/rarely	.
❖ Never	0

# Comprehension Review

1. Newton's work helped us to understand the natural world better. T
2. Newton's first law was in agreement with the Aristotelian view of motion. F

# Comprehension Review

- ۳. The daily movement of the earth has NO effect on our lives. F
- 4. An accelerating car is NOT considered on inertial frame. T
- 5. There are NOT any forces acting on a moving car. F

# Comprehension Review

6. A driver accelerates relative to the car but NOT relative on the ground. F

7. There is NO net force on an object which has a uniform motion. T

**Answer the following questions  
in Farsi**

- 1. What is the importance of Newton's laws of motions?**
- 2. What is an inertial coordinate system and why is it needed?**
- 3. What is the role of friction in motion?**

# Vocabulary Review

❖ The vector sum of all the forces acting on an object is equal to the product of its mass and ----- .

a. accelerate

b. acceleration ←

c. accelerator

d. accelerated

# Vocabulary Review

❖ During ----- motion, the distance between two points on an object or system is fixed.

a. rotate

b. rotation

c. rotational ←

d. rotated



# Vocabulary Review

❖ The ----- of the earth on its axis around the sun takes about 365 days.

a. revolve

b. revolution ←

c. revolved

d. revolving

# Vocabulary Review

❖ Those who have their own business usually increase prices to offset inflation for themselves.

a. balance ← b. decrease  
c. state d. apply

# Vocabulary Review

❖ A car's wheels can be detached by removing their nuts.

- a. damaged      b. repaired  
c. separated ←      d. derived

# Vocabulary Review

❖ It is found that the -----  
force on an object is the sum  
of all the forces acting on it.

a. inertia

b. dense

c. net ←

d. potential

# Vocabulary Review

❖ Newton's study of planetary motion led him to infer the formula for the ----- force between two objects.

- a. frictional    b. gravitational ←  
c. inertial      d. perpendicular

# Vocabulary Review

❖ The law of universal gravitation ----- that all objects in the universe attract each other.

a. analyzes

c. applies

b. states ←

d. perceives

# Vocabulary Review

❖ Given the angular  $\omega$  and the initial angular position and velocity, we can find the subsequent motion.

a. mass

b. balance

c. vector

d. acceleration 

# Vocabulary Review

❖ ----- is a force that always acts to resist the motion of one object sliding on another.

a. Gravitation

b. Oscillation

c. Diffusion

d. Friction ←



# Vocabulary Review

❖ The quantity that indicates the ability of a force to cause ----- is called the torque.

- a. rotation ←
- b. conservation
- c. derivation
- d. compression

# Vocabulary Review

❖ The earth rotates about a(n)  
----- between the North  
Pole and the South Pole.

a. equator

c. process

b. axis ←

d. orbit

# Vocabulary Review

❖ When you release something,  
----- causes it to fall to the  
ground.

a. gravity ←

c. quantity

b. velocity

d. density

# Vocabulary Review

❖ The way in which our muscles work is studied in ----- .

a. geology

b. astronomy

c. biomechanics ←

d. engineering

# UNIT FIVE

## Newton's Laws of Motion

### Part Two

#### Key Words

- ❖ Gravitational mass
- ❖ Inertial mass
- ❖ Propel
- ❖ Scalar quantity
- ❖ Vector quantity

# General Words

- ❖ Analyze
- ❖ Determine
- ❖ Illustrate
- ❖ Magnitude
- ❖ Proportional
- ❖ Times

## Ways of combining sentences (line 4)

### 1. Positive sentences:

❖ He is happy, and so am I.

❖ He is happy, and I am happy too.

## Ways of combining sentences (line 4)

### 2. Negative sentences:

- ❖ He isn't happy, and I am not either.
- ❖ He isn't happy, and neither am I.



Frequent use of type 1 conditional sentence in technical texts (line 5)

❖ If you heat water, it boils.

❖ If you let go of an object, it falls to the ground.

Relative clauses are frequently shortened (line 32)

❖ Thus the net force on the sled is the 20-N force (that is) exerted by the child.

A clause used the object or subject  
(line 40)

**Object:** We can see now why  
the equality of the action and  
reaction force is ...

**Subject:** What he did yesterday  
surprised me.

Words or expressions that show similarity between sentences (line 49)

❖ Also

❖ Besides

❖ Similarly

❖ In addition to

❖ Furthermore

❖ As a matter of fact

# Comprehension Review

1. A net force on an object and the acceleration of the object have opposite directions. F
2. Physicists usually use the word "mass" to refer to both inertial and gravitational masses. T

# Comprehension Review

3. The mass of an object is its inertia. T
4. The weight of an object is a scalar quantity. F
5. We quickly know when the action and reaction force are equal. F

# Comprehension Review

6. The third law does not apply when objects are moving. F

7. Different forces may determine the motion of an object. T

# Answer the following questions in Farsi

1. Explain the second law of motion.
2. Explain the third law of motion.
3. Explain the first example.
4. Explain the second example.



# Vocabulary Review

❖ The Oxford Advanced Learner's dictionary uses ----- to make the meaning of words clear.

a. illustrate

b. illustrations



c. illustrative

d. illustratively

# Vocabulary Review

❖ He ----- studied medicine but later decided to become a physicist.

a. initiate

b. initiation

c. initially ←

d. initiative

# Vocabulary Review

❖ Physical sciences have undergone great changes in the past 30 years.

a. determined

b. experienced ←

c. analyzed

d. balanced

# Vocabulary Review

❖ The mass of an object is a ----- that is the same whether the object is in space or on the moon.

- a. property ←      b. proportion  
c. magnitude      d. motion

# Vocabulary Review

❖ If air resistance is significant, then the ----- of the motion of body becomes rather complicated.

a. interval

b. interplay

c. crudity

d. analysis ←

# Vocabulary Review

❖ The forces between two spheres or point particles are ----- proportional to the square of their separation.

- a. conversely
- b. reciprocally
- c. inversely ←
- d. initially

# Vocabulary Review

❖ Atoms and molecules may vibrate or bend when they are ----- by certain forces.

a. circulated

b. affected ←

c. subjected

d. applied

# Vocabulary Review

❖ ----- are  
mathematical objects  
having both a magnitude  
and a direction.

a. Tunes

b. Scalars

c. Frames

d. Vectors ←



# Vocabulary Review

❖ The ----- of an earthquake's force is measured on the Richter scale.

a. acceleration

b. mass

c. magnitude ←

d. gravity

# Vocabulary Review

❖ The angular momentum of a rigid body rotating about a fixed axis is its moment of inertia ----- its angular velocity.

a. plus

b. minus

c. divided by

d. times 

# Vocabulary Review

❖ To ----- a problem, we usually separate it into its parts in order to study its nature and structure.

a. analyze ←

b. arise

c. apply

d. affect

# Vocabulary Review

❖ A barometer is used to-----  
atmospheric pressure.

a. dominate

b. determine ←

c. proportion

d. propel

# Vocabulary Review

❖ The earth is much more  
----- than the moon.

a. potential

b. reciprocal

c. inverse

d. massive ←

# UNIT SIX

## Temperature

### Key Words

- ❖ Absolute temperature
- ❖ Kinetic energy
- ❖ Temperature scale
- ❖ Thermal energy
- ❖ Thermodynamics

# General Words

- ❖ Contact
- ❖ Equation
- ❖ Finite
- ❖ Precision
- ❖ Recoverable
- ❖ Reproducible

# Relative clause beginning with v-ing (line 10)

- ❖ Likewise, we will agree  
that the ice *(that cools)*  
cooling our lemonade is  
colder than our hands.



## Passive sentence (line 17)

- ❖ When two objects, one hotter and one colder, are placed in contact, the energy transfer proceeds only for a finite time.

## Changing active to passive sentence

- ❖ He will repair the car.
- ❖ The car will be repaired.
  
- ❖ She might write a letter.
- ❖ A letter might be written.

## Changing active to passive sentence

- ❖ He has painted the house.
- ❖ The house has been painted.
  
- ❖ He is painting the house.
- ❖ The house is being painted.

## Three basic types of English sentence (line 29)

### *1. Simple sentence:*

- ❖ Several such properties are available.

### *2. Compound Sentence:*

- ❖ The weather was bad, so we stayed home.

# The third basic type of English sentence

## *3. Complex Sentence:*

❖ Independent clause + dependent clause

❖ Ali entered the university after he finished school.

## Some frequent phrasal verbs (line 39)

- ❖ Consist of
- ❖ Show up
- ❖ Hinge on
- ❖ Cancel out
- ❖ Deal with
- ❖ Get over
- ❖ Slow down

# Comprehension Review

1. Words such as hot or cold do NOT have completely clear meanings. T
2. As a result of friction, part of kinetic energy turns into thermal energy. T

# Comprehension Review

3. The method that Galileo found is still used. T

4. There is a visible liquid and some air in a standard thermometer. F



# Comprehension Review

5. The color of materials change when their temperatures increase a lot. T
6. Celsius scale uses the same reference points as the Fahrenheit scale. F

# Answer the following questions in Farsi

1. What are the different properties used to measure temperature?
2. What does a standard thermometer consist of?
3. What is the advantage of the Kelvin scale?

# Vocabulary Review

❖ Modern copier machines can  
----- color photographs.

a. reproduce ←

b. reproduction

c. reproducible

d. reproducibility

# Vocabulary Review

❖ Time is not ----- at all.  
When you spend it, you cannot  
bring it back.

a. recover

b. recovery

c. recoverable ←

d. recovers

# Vocabulary Review

❖ The number of grammatical rules in any language is finite, but the number of possible sentences is infinite.

a. accurate

b. limited ←

c. complicated

d. implicit

# Vocabulary Review

❖ In classical mechanics,  
----- energy is proportional  
to the square of a particle's  
velocity.

a. thermal

b. gravitational

c. kinetic ←

d. electromagnetic

# Vocabulary Review

❖ We can use the ----- for constant acceleration to analyze the relative jumping ability of various animals.

a. direction

b. equation ←

c. assumption

d. gravitation

# Vocabulary Review

❖ The ----- temperature on the Fahrenheit scale is  $-459.60^{\circ}$  F.

a. artificial

b. kinetic

c. absolute ←

d. nuclear



# Vocabulary Review

❖ If you want to measure the temperature of a heated material, you should use an optical----- .

a. pyrometer ←

b. thermometer

c. thermocouple

d. chronometer

# Vocabulary Review

❖ The ----- force between two objects of moderate mass is very small and hard to detect.

- a. frictional      b. gravitational ←
- c. kinetic        d. geometrical

# Vocabulary Review

❖ In most modern gas stoves and heaters ----- are used to stop the gas flow.

a. thermistors

b. accelerators

c. thermocouples ←

d. regulators

# Vocabulary Review

❖ A chemical reaction happens when two substances are in ----- with each other.

a. effect

b. contact ←

c. practice

d. turn

# Vocabulary Review

❖ Scientists believe that it is possible to ----- the satellite that has gone of its orbit.

a. duplicate

b. evoke

c. illustrate

d. recover ←

# UNIT SEVEN

## Magnetic Field

### Key Words

- ❖ Current
- ❖ Electromagnet
- ❖ Gravitational field
- ❖ Magnetic field
- ❖ Compass
- ❖ torque

# General Words

- ❖ Align
- ❖ Interaction
- ❖ Navigate
- ❖ Notion
- ❖ Specify
- ❖ Speculation
- ❖ symmetric

## Two verbs used together (line 8)

- ❖ He decided to go.
- ❖ He stopped working hard.
- ❖ He avoided seeing me.
- ❖ He tried to pass the test.
- ❖ He tried working harder.



## Some uses of "so" (line 16)

- ❖ He was so tired that he slept.
- ❖ Did he pass? I think so.
- ❖ He studied hard, so he passed the test.
- ❖ So, you said you failed.

## Emphatic and reflexive pronouns (line 28)

- ❖ I saw the president himself.
- ❖ He himself did it.
  
- ❖ I saw myself in the mirror.
- ❖ He looked at himself.

# Changing nouns to adjectives (line 38)

- ❖ Magnet + ic = magnetic
- ❖ Danger + ous = dangerous
- ❖ Evolution + ary = evolutionary
- ❖ Friction + al = frictional
- ❖ Mass + ive = massive

## verb-ing after prepositions (line 53)

- ❖ He insisted on going.
- ❖ I am thinking of finding a job.
- ❖ I look forward to seeing you.
- ❖ He made a mistake in judging me.

# Comprehension Review

1. Scientists are completely sure that migratory birds have a biological compass. F
2. There is an organ in man that helps him sense the direction of a steady magnetic field. F

# Comprehension Review

3. The discovery of the connection between magnetism and electricity is about three centuries old. T

4. A pattern of iron filings shows the same magnetic influence all over it. F

# Comprehension Review

5. A vector field has a magnitude and direction at every point in space. T

6. A perpendicular force can be at right and left directions at the same time. F

# Answer the following questions in Farsi

1. What general information do we have about magnets?
2. What is the relation between electricity and magnetism?
3. How can we define a magnetic field?



# Vocabulary Review

❖ Astronomers ----- that there might be life on some other planet in our galaxy.

a. speculate ←

b. speculation

c. speculative

d. speculatively

# Vocabulary Review

❖ The police ----- told us to avoid the main road because it was under construction.

a. specified

b. specification

c. specific

d. specifically ←

# Vocabulary Review

❖ Some tribes ----- along with their cattle in search of fresh grass.

a. migration

b. migrant

c. migrate ←

d. migratory

# Vocabulary Review

❖ I didn't tell him anything about myself; he seemed to have an ----- knowledge of my feeling.

a. intuit

b. intuition

c. intuitive ←

d. intuitively

# Vocabulary Review

❖ The old notion that the sun moved around the earth is not accepted by anybody now.

a. memory

b. effect

c. sense

d. idea ←

# Vocabulary Review

❖ It is only a speculation that creatures from other planets have visited the earth.

a. effort

b. guess ←

c. evidence

d. approach

# Vocabulary Review

❖ The centers of gravity of uniformly dense ----- objects are at their geometric centers.

a. transverse

b. reproducible

c. symmetric ←

d. consistent

# Vocabulary Review

❖ A vector in a given plane is ----- by two pieces of information, its magnitude and its direction.

a. specified ←

b. dominated

c. analyzed

d. implied



# Vocabulary Review

❖ A (n) ----- consists of a piece of metal with wire wound around it.

a. thermometer      b. insulator

c. apparatus      d. armature ←

# Vocabulary Review

❖ The rotational state of motion will be unchanged if there is no net twisting effect or ----- on the object.

a. torque ←

b. core

c. vector

d. ion

# Vocabulary Review

❖ Gravitational and -----  
forces are two of the  
fundamental forces in nature.

a. frictional

b. inertial

c. vacuous

d. electromagnetic ←

# Vocabulary Review

❖ An astronaut in free fall has a zero effective weight and ----- himself to be weightless.

- a. perceives ←
- b. identifies
- c. avoids
- d. recovers

# UNIT EIGHT

## Electrostatic Forces

### Key Words

- ❖ Amber
- ❖ Electrostatic forces
- ❖ Static electricity
- ❖ Electric charge
- ❖ Insulator
- ❖ Conductor

# Key Words

- ❖ Electron
- ❖ Proton
- ❖ Neutron
- ❖ Nucleus
- ❖ Electroscope
- ❖ Positive/negative charge

# General Words

- ❖ Acquire
- ❖ Constant
- ❖ Rubber
- ❖ Suspend
- ❖ Attraction
- ❖ Rod
- ❖ Postulate

# General Words

- ❖ Residual
- ❖ Restore
- ❖ Substitute
- ❖ Transfer
- ❖ Neutral
- ❖ Fundamental




# Changing adjectives to nouns (line 9)

- ❖ Electric + ity = electricity
- ❖ Dense + ity = density
- ❖ Precise + sion = precision
- ❖ Massive + ness = massiveness

## Present perfect and its difference with simple past (line 26)

- ❖ The combination of a rubber rod and fur has become fairly standard...
- ❖ I have read this book.
- ❖ I read this book.

The use of “do” instead of a main verb (line 37)

- ❖ Some materials do not display this power of attraction after being rubbed with fur; for example, no metals do.
- 

Frequent type 1 conditional sentence in technical texts (line 43)

❖ The effect is easier to observe if a small ball of pith ... is used.

❖ If you press the button, the machine starts.

## Relative clauses with and without commas (line 62)

- ❖ Materials which seem to confine charge to wherever it is placed are ...
- ❖ Mr. Ahmadi, who is my uncle, is a physicist.

## Reading formulas (line 81)

❖  $10^{22} =$  ten to the power of 22

❖  $F/a =$  F is over a

❖  $6 \times 10 =$  six times ten/six by ten

❖  $10 \div 5 =$  ten divided by five

## Reading formulas (line 81)

❖  $10.5 - 5.3 =$  ten point five  
minus five point three

❖  $2 + 2 = 4$  = two plus two  
equals four

# Some frequent compound prepositions (line 88)

- ❖ In accordance with
- ❖ According to
- ❖ Due to
- ❖ Because of
- ❖ In spite of
- ❖ In response to



Frequent use of passive in technical texts (line 118)

❖ The differences between electric conductors and insulators are explained by the atomic model.

❖ Object + be + PP + by subject

# Comprehension Review

1. The Greek word for amber is the origin of the word "electricity". T
2. Almost everybody can repeat the experiment done by Thales. T

# Comprehension Review

3. Metals can Not be charged by rubbing. T

4. Materials such as cotton or silk are weak conductors. F

5. To get a positive charge, a body must lose some electrons. T

# Comprehension Review

6. When a body's charges are balanced, its positive charge is larger than its negative charge. F

7. When the gold leaf remain deflected, we can say the electroscope is charged. T

**Answer the following questions  
in Farsi**

**1. How does an electroscope  
work?**

**2. What is the difference  
between charging by  
conduction and charging by  
induction?**

# Vocabulary Review

❖ Foam rubber provides good  
----- for high voltage  
electricity.

a. insulating

b. insulated

c. insulation ←

d. insulate

# Vocabulary Review

❖ In central heating systems water is used to ----- heat.

- a. conduct ←
- b. conductive
- c. conductor
- d. conduction

# Vocabulary Review

❖ As higher education plays an important role in our country's progress, it warrants enough budget and attention.

a. advances

b. replaces

c. remains

d. deserves ←



# Vocabulary Review

❖ The ----- of electricity can cause heat when there is high resistance in the conductor.

a. induction

b. conduction ←

c. suspension

d. perception

# Vocabulary Review

❖ An oil lamp was -----  
from the ceiling above us.  
There was no electricity there.

- a. suspended ← b. warranted  
c. interpreted d. credited

# Vocabulary Review

❖ The handle of screwdrivers is covered with a(n) ----- to prevent electric shocks.

a. conductor

b. absorber

c. insulator ←

d. accelerator

# Vocabulary Review

❖ Since ancient times, -----  
has been known as an  
accumulator of static  
electricity.

a. metal

b. substance

c. amber ←

d. magnet

# Vocabulary Review

❖ This program will destroy the residual viruses in your computer.

a. remaining ← b. determining  
c. revolving d. exciting

# Vocabulary Review

❖ The tests showed that his theory is only partially true. We should not accept it completely.

a. periodically

b. respectively

c. partly ←

d. mainly

# Vocabulary Review

❖ In the next century, atomic and solar energy are the possible ----- for fossil fuels.

a. signals

b. scales

c. subfields

d. substitutes ←

# Vocabulary Review

❖ At present, many artificial satellites are ----- our planet.

a. perceiving      b. initiating

c. conserving      d. orbiting ←



# Vocabulary Review

❖ I touched the wire after the  
----- showed that there  
was no current in it.

a. electroscope ←

b. spectroscope

c. telescope

d. microscope

# Vocabulary Review

❖ They are going to decide on the ----- distance of the satellite from the earth.

- a. frictional    b. orbital ←  
c. inertial      d. gravitational

# Vocabulary Review

❖ The earth is kept in a nearly circular ----- by the gravitational attraction of the sun.

a. orbit ←

c. vicinity

b. axis

d. slit

# UNIT NINE

## Physical Optics

### Key Words

- ❖ Electromagnetic waves
- ❖ Optics
- ❖ Trough
- ❖ Opaque
- ❖ Transparent
- ❖ wavelength

# General Words

- ❖ Advance
- ❖ Cotemporary
- ❖ Duplicate
- ❖ Fabricate
- ❖ Invariably
- ❖ Postulate

## Review of modal verbs (line 5)

**Intention:** I will help you.

**Ability:** I can lift this box.

**Possibility:** He may/might  
arrive later.

## Review of modal verbs (line 5)

**Permission:** You can/may use my car.

**Suggestion/advice:** You should see a doctor.

**Obligation:** We must respect others.

## The use of “already”, “yet” and “still” (line 22)

❖ I have already seen this film.

❖ Ali has not returned home yet.

❖ He is still studying physics.



# Stress shift changes a verb to a noun

- ❖ Con'duct: verb
- ❖ 'Conduct: noun
- ❖ Con'tract: verb
- ❖ 'Contract: noun
- ❖ Dis'charge: verb
- ❖ 'Discharge: noun

Some words have the same form for a noun and an adjective (line 38)

❖ Contemporary

❖ Duplicate

❖ Fundamental

❖ Potential

Some words have the same form  
for a verb and an adjective but  
with a difference in pronunciation

❖ Elaborate

❖ Separate

❖ Absent

❖ Alternate

Some words have the same form for a verb, a noun, and an adjective

- ❖ Duplicate
- ❖ Alternate
- ❖ Major

# Comprehension Review

1. Physical optics deals with the study of the wave nature of light. T
2. Newton and Huygens had the same ideas about the nature of light. F

# Comprehension Review

3. According to the passage, the corpuscular theory is completely wrong. F
4. Interference happens when two or more waves pass through each other. T

# Comprehension Review

5. The interference phenomenon is based on superposition principle. T

6. Only constructive interference can be observed on the surface opposite the double slits. F

**Answer the following questions  
in Farsi**

- 1. What did Newton do in the experiments regarding the nature of light?**
- 2. What did Huygens say about the nature of light?**



# Vocabulary Review

❖ We must avoid -----  
research studies. We should  
do new researches.

- a. duplicating ←      b. duplicate  
c. duplication        d. duplicates

# Vocabulary Review

❖ In Iran it is ----- for men to serve in army for two years.

a. oblige

b. obligation

c. obliging

d. obligatory ←

# Vocabulary Review

❖ This area has -----  
temperature. It always remains  
around 20 degrees Celsius.

- a. transparent
- b. transparency
- c. invariability
- d. invariable ←

# Vocabulary Review

❖ Scientists sometimes have to fabricate some situations which normally may not exist.

a. invent ←

c. move

b. accept

d. force

# Vocabulary Review

❖ Simple water invariably changes into steam when it reaches the temperature of 100 degrees Celsius.

a. usually

b. nearly

c. almost

d. always ←

# Vocabulary Review

❖ In -----, which is a branch of physics, particular emphasis is given to the visible and ultraviolet regions.

- a. optics ←
- b. mechanics
- c. astrophysics
- d. mathematics

# Vocabulary Review

❖ A new type of plastic has been made which is as ----- as glass but is much stronger.

a. optical

b. accurate

c. consistent

d. transparent ←

# Vocabulary Review

❖ The dust in the air -----  
up in a ray of sunlight.

a. shows ←

c. spreads

b. makes

d. gives



# Vocabulary Review

❖ He ----- that by the year 2050 man will be able to live on the moon.

- a. substituted      b. postulated ←  
c. duplicated      d. concentrated

The background of the image is a photograph of a vast blue ocean under a bright blue sky with wispy white clouds. The horizon line is visible in the upper third of the frame. The text is centered horizontally and vertically.

**THE END**

**GOOD LUCK**

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