



Students' Life / fragment of the picture by Ivan Koulakov

## MODULE 2

### DISCOVERIES AND INVENTIONS

#### Part 1 Brilliant Minds

*"If I have seen further, it is by standing on the shoulders of giants."*  
— Isaac Newton, *The Correspondence of Isaac Newton: Volume 5*,

#### Grammar Focus: Past Tenses

#### WARM-UP

**Ex.1** Do you know what these scholars are famous for? Match the scientists with their achievements.

#### Famous Scholars

#### Discoveries and Inventions

Archimedes (287 BC -322 BC) Ptolemy (90 AD – 168 AD) Copernicus (1473 – 1543) Kepler (1571 – 1630) Newton (1642 – 1726) Volta (1745 – 1827) Maxwell (1831 – 1879) Heinrich Hertz (1857 – 1894) Rontgen (1845 – 1923) Becquerel (1852- 1908) Plank (1958 – 1947) Einstein (1879 -1955) Hubble (1889 – 1953)	three laws of planetary motion X-rays buoyancy principle. the model of the heliocentric solar system the idea of electro-magnetic waves three laws of motion and the law of gravity the first storage battery the first quantum formula radio waves the Earth-centered model of the Solar system radioactivity the idea of an expanding universe the special theory of relativity
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**Ex.2 Use the following verbs to make the full sentences about the discoveries and inventions listed in Ex.1.**

Verb	Translation
to argue	утверждать, аргументировать; спорить
to assume	допускать, предполагать
to create	создавать
to describe	описывать
to develop	развивать
to discover	открыть (закон)
to formulate	сформулировать
to introduce	ввести, внедрить, ознакомить
to invent	изобретать
to observe	вести наблюдения, наблюдать; соблюдать (правила)
to obtain	получить (формулу, результат)
to prove	доказать
to propose	предлагать
to publish	опубликовать
to study	изучать

**Ex.3 Combine the following nouns with the verbs from Ex.2 to make *verb + noun* phrases.**

Law, theory, idea, model, principle, equation, formula (formulae), phenomenon (phenomena), method, article, new technology, school

*Model: to discover a law / to formulate a law*

## GRAMMAR: PAST TENSES (REVIEW)

**Ex. 4 Read the joke about Albert Einstein\*. What's the punch-line?**

**What verb forms are underlined? What is the difference in their use?**

Albert Einstein toured around the country and gave lectures. His driver used to sit at the back of the hall during each of his lectures. After Einstein had been lecturing for quite a while, the driver remarked to Einstein that he could probably give the lecture himself, as he had already heard it several times.

So, at the next stop on the tour, Albert Einstein and his driver switched places. Now Einstein was sitting at the back, in driver's uniform, while the driver was giving the lecture, flawlessly. At the end of the talk, a member of the audience asked a detailed question about the subject. The lecturer replied that the answer to the question was quite simple and even his driver could answer it. He said that his driver was just sitting at the back there.

**Ex.5 Look through the explanations of the Past Tenses and the examples given. Make your own examples of questions and negatives.**

<p><b>PAST SIMPLE</b>  <b>V2 (Ved)</b></p> <ul style="list-style-type: none"> <li>- a single completed action in the past</li> <li>- repeated actions in the past</li> <li>- a series of actions (when one thing happens after another) in the past</li> <li>- situations that finished in the past</li> </ul> <p><b>**used to V (имел обыкновение делать)</b></p>	<p><i>affirmative:</i>  <i>Einstein <u>toured</u> the country. He <u>gave</u> lectures.</i></p> <p><i>negative:</i></p> <p><i>question:</i></p> <p><b>**affirmative:</b> <i>He <u>used to sit</u> at the back</i></p> <p><i>negative:</i></p> <p><i>question:</i></p>
<p><b>PAST CONTINUOUS</b>  <b>was + Ving</b>  <b>were + Ving</b></p> <ul style="list-style-type: none"> <li>- a longer continuous action / situation at or around a time in the past, temporary past situation</li> <li>- background situation in the past, to 'set the scene' for a story</li> <li>- two actions / situations happening at the same time</li> </ul>	<p><i>affirmative:</i>  <i>Einstein <u>was sitting</u> in driver's uniform while his driver <u>was giving</u> a lecture.</i></p> <p><i>negative:</i></p> <p><i>question:</i></p>
<p><b>PAST PERFECT SIMPLE</b>  <b>had + V3 (Ved)</b></p> <ul style="list-style-type: none"> <li>- an action which happened <u>before</u> the time in the past</li> <li>- to show which action in the past happened first</li> </ul>	<p><i>affirmative:</i>  <i>The driver remarked that he <u>had</u> already <u>heard</u> it.</i></p> <p><i>negative:</i></p> <p><i>question:</i></p>
<p><b>PAST PERFECT CONTINUOUS</b>  <b>had + been + Ving</b></p> <ul style="list-style-type: none"> <li>- an action happening before another action or time in the past</li> </ul>	<p><i>affirmative:</i> <i>After Einstein <u>had been lecturing</u> for quite a while, his driver could give the lecture himself.</i></p> <p><i>negative:</i></p> <p><i>question:</i></p>

**Ex.6 Read about a discovery Einstein made in 1905. What did he discover and under what circumstances?**

And then, on what Einstein later remembered as a beautiful day in the spring of 1905, he went for a long walk on the outskirts of the city. Today Einstein was uneasy. In the past few months, a great deal of what he'd been thinking about had started coming together, but there was still something Einstein felt he was very near to understanding but couldn't quite see. That night Einstein still could not quite grasp it, but the next day when he suddenly woke up, he was feeling the greatest excitement.

It took just five or six weeks to write up a first draft of the article, filling thirty-some pages. It was the start of his theory of relativity. He sent the article to be published, but a few weeks later, he realized that he had left something out. A three-page supplement was soon delivered to the same physical journal.

$E=mc^2$  arrived in the world.

**Ex.7 Find 1-2 examples of each of the Past Tenses in Ex.6 and explain the use of the tenses.**

**LISTENING**

**Ex.8 Before you listen, discuss these questions with your partner.**

Have people always believed that the Earth goes round the Sun? Why do you think people would doubt this?

**Ex.9 Listen to the radio program about Copernicus. Then complete these notes and listen again to check.**

Nicolaus Copernicus (<sup>1</sup>\_\_\_\_\_ ) a Polish astronomer, provided the first (<sup>2</sup>\_\_\_\_\_ ) theory of the solar system.

Copernicus held many important positions and studied in many fields, including (<sup>3</sup>\_\_\_\_\_ and \_\_\_\_\_). His ideas led the way for science to question theories already held. He called into question (<sup>4</sup>\_\_\_\_\_ ) that knowledge came from what we understood with our senses.

There were seven parts in his heliocentric theory. Firstly, the universe doesn't have one (<sup>5</sup>\_\_\_\_\_). Secondly, the Earth is not the centre of the universe. Thirdly, any centre of the universe is near the Sun. Fourthly, the distance from the Earth to (<sup>6</sup>\_\_\_\_\_ ) is nothing if you compare it to the distance from the Earth to (<sup>7</sup>\_\_\_\_\_). Fifthly, the fact that the Earth revolves explains why the stars also revolve. Sixthly, the apparent movement of the Sun is caused by the Earth revolving around the Sun. And finally, the apparent (<sup>8</sup>\_\_\_\_\_ ) of the planets is caused by the motion of the Earth, from which they are observed.

Moreover, he gave the correct order of (<sup>9</sup>\_\_\_\_\_ ) and he showed why (<sup>10</sup>\_\_\_\_\_).



*Colorful Science / fragment of the picture by Ivan Koulakov*

## Module 2 Part 2

### Milestones in Physics

*“I would rather have questions that can't be answered than answers that can't be questioned.”*  
— Richard Feynman

### Grammar focus: Past Simple and Past Continuous

#### WARM-UP

**Ex.1** In your opinion, what are the top 10 physicists of all times? What is the importance of their discoveries and inventions? Discuss in small groups.  
Watch the video and compare your ideas.

[https://www.youtube.com/watch?v=3Bhq5c6LoZo&ab\\_channel=WatchMojo.com](https://www.youtube.com/watch?v=3Bhq5c6LoZo&ab_channel=WatchMojo.com)

Top 10 Physicists of all times:

[https://www.youtube.com/watch?v=6XZuQkUVs\\_0&ab\\_channel=UniqueStuff](https://www.youtube.com/watch?v=6XZuQkUVs_0&ab_channel=UniqueStuff)

#### READING

**Ex.2** Read the text and choose the best title (A-G) for each paragraph (1-6). There is one title, which you do not need to use.

- (A) Atomic physics
- (B) Science in Classical antiquity
- (C) Mechanical devices
- (D) Challenges nowadays
- (E) What we can learn from physics
- (F) Ideas that speeded up the industrial revolution
- (G) Scientific revolution and the origin of modern physics

## Brief History of Physics

(1) Why do things fall to the ground, not away from it? Why do the stars move? Why does the Sun come up in the east and go down in the west? These are all questions that physics can answer, and a lot more...

(2) In the beginning, people answered questions like these in philosophical or religious ways. A Greek philosopher Aristotle (384 BC – 322 BC) developed his theory of five elements (earth, water, fire, air, and aether). \_\_\_\_ Archimedes (287 BC – 212 BC) discovered his principle of buoyancy. Ptolemy (90 – 168 AD), created an Earth-centered model of the Solar system (which **survived** for almost a thousand years).

(3) The works of Eastern scholars reached Europe in the 12th and 13th centuries. There were studies of planetary motion by Indian astronomers, the theories of light from Buddhist and Persian thinkers and especially the work of the Persian philosopher Nasir al-Din al-Tusi on the planetary system. **Eventually**, these ideas pushed Europe into a scientific revolution. Copernicus explained the planetary motion in his Sun-centered system. Johannes Kepler formulated three laws of planetary motion. After Galileo had built one of the first telescopes, he **noticed** the phases of Venus and the four tiny moons of Jupiter, two things that **convinced** him in the Copernican system. \_\_\_\_\_

(4) The next great area of **investigation** was electricity and in the 19th century Michael Faraday first demonstrated an electromagnetic motor. Later, it was **improved** by James Clerk Maxwell, whose **equations** were also used to describe light. In proving Maxwell's equations, Heinrich Hertz discovered radio waves and Wilhelm von Röntgen, X-rays. Maxwell's work was also the starting point for Einstein's Theory of Relativity. At the same time, other scientists were working on thermodynamics, that is, the study of changes of heat in matter. \_\_\_\_ Röntgen's discovery of X-rays and the work of Pierre and Marie Curie on radioactivity led to the development of the science of nuclear physics.

(5) In the first half of the 20th century, developments in physics were **concerned** with the structure of atoms. The parts of the atom were identified – its nucleus, protons and electrons. \_\_\_\_ Also at that time, scientists such as Max Plank were looking at the relationship between matter and wave motion. The field of quantum mechanics, which explains not only how atomic particles move, but how the universe does, came into being.

(6) Since the 1970s, fundamental particle physics has **provided insights** into early universe cosmology, particularly the “Big Bang” theory. However, starting from the 1990s, astronomical observations have also provided the need for new explanations of galactic stability (the problem of dark matter), and **accelerating** expansion of the universe (the problem of dark energy).

### Ex.3 Some parts (a - d) have been taken out of the text. Where do they belong?

a) Physicists such as Robert Boyle, James Prescott Joule and many others **set out** the theories that allow us today to make use of engines and other mechanical devices.

b) In this theory, the light elements (fire and air) had a natural tendency to move away from the center of the universe while the heavy elements (earth and water) had a natural tendency to move toward the center of the universe, thereby forming a spherical earth. Since the celestial bodies - that is, the planets and stars - were seen to move in circles, he **concluded** that they were made of a fifth element, which he called aether.

c) Eventually in the 1940s, scientists in the USA were able to **split** a nucleus and the result was the world's first nuclear explosion.

d) In 1687, building on their work, Isaac Newton set out his Laws of Motion and modern physics was born. Moreover, Newton and Leibniz **independently** developed calculus (the branch of mathematics and the so-called language of physics).

## VOCABULARY

**Ex.4 Study the definitions of the words from the text. Then do the exercises that follow.**

<b>to accelerate</b>	(v.) to begin to move more quickly
<b>to concern</b>	(v.) to relate to, be about, involve; to worry, to interest concern (n.) - interest, business, worry
<b>to conclude</b>	(v.) to decide; to finish; to say your last remark
<b>to convince</b>	(v.) to make smb to believe, to persuade
<b>equation</b>	(n.) mathematical statement that two values are equal
<b>eventually</b>	(adv.) finally, in the end, after a lot of problems
<b>to improve</b>	(v.) to make or become better
<b>independently</b>	(adv.) individually, free from outside control or help
<b>insight</b>	(n.) sudden accurate and deep understanding of a problem
<b>investigation</b>	(n.) examination, inquiry, research
<b>to notice</b>	(v.) to see, catch sight of, observe
<b>to provide</b>	(v.) to give, supply, make available
<b>to set out</b>	(v.) to explain in a clear and organized way
<b>to split</b>	(v.) to crash, divide; share
<b>to survive</b>	(v.) to continue to live or exist in spite of hardships

**Ex.5 Complete the sentences to demonstrate your knowledge of the words in bold.**

- 1 To **accelerate** the speed of reaction we can \_\_\_\_\_.
- 2 If something **concerns** me, it \_\_\_\_\_.
- 3 We use the phrase 'To whom it may **concern**' when \_\_\_\_\_.
- 4 A typical way to **conclude** your presentation is \_\_\_\_\_.
- 5 A fun way to **conclude** a lecture would be \_\_\_\_\_.
- 6 If I were **convincing** a friend of mine to have enough sleep, \_\_\_\_\_.
- 7 The world's most famous **equation** is probably \_\_\_\_\_.
- 8 If a student **eventually** passes his finals, it means that \_\_\_\_\_.
- 9 I will try to **improve** \_\_\_\_\_.
- 10 When I am doing something **independently** \_\_\_\_\_.

**Ex.6 Translate the sentences into English. When in doubt, check with the text.**

1. Греческий философ Аристотель разработал теорию пяти элементов.
2. Наблюдали, что небесные тела движутся по кругу.
3. Архимед открыл принцип плавучести.
4. Птолемей создал геоцентрическую модель солнечной системы.
5. Кеплер сформулировал три закона планетарного движения.
6. Галилео построил один из первых телескопов.
7. Ньютон и Лейбниц независимо друг от друга разработали интегральное и дифференциальное исчисление.
8. Фарадей впервые продемонстрировал электромагнитный мотор.
9. Учёные использовали уравнения Максвелла для описания света.
10. Максвелл усовершенствовал электромагнитный мотор.
11. Были определены части атома, - ядро, протоны и электроны.
12. Рентген открыл X-лучи.
13. В конце концов, учёные США расщепили атом.

**GRAMMAR: PAST SIMPLE, REGULAR / IRREGULAR VERBS**

**Ex.7 Read the text about Michael Faraday. Complete the sentences with the Past Simple tense of the verbs in brackets.**

Michael Faraday (be) born on 22 September 1791 in London. His family was not well off. The young Michael Faraday, who was the third of four children, having only the most basic school education, (have) to educate himself. At the age of 14 he (become) an apprentice to a local bookbinder and bookseller. During his seven-year apprenticeship Faraday (read) many books that (pass) through the shop. Besides his own reading, his only education (consist) of some lectures on natural philosophy and chemistry.

Faraday also (develop) an interest in science, especially in electricity and he (begin) to do simple experiments. In 1812, at the end of his apprenticeship, Faraday (attend) lectures by the eminent English chemist Humphry Davy. Faraday (send) Davy a 300-page book based on notes that he had taken during these lectures. Davy's reply (be) immediate, kind, and favorable; later he (decide) to employ Faraday as an assistant at the laboratory at the Royal Institute where he (begin) original investigations, initially in chemistry and then in electricity.

From 1816 to 1819 he (publish) 37 papers. Faraday (become) interested in electromagnetism in 1821 and (make) some experiments. Though they (be) unsuccessful, the phenomenon (excite) his interest and he (decide) to study it. In the summer of 1831, after years of patient and persistent experiments, Faraday (discover) the electromagnetic induction.

**Ex. 8 In the text above (see ex.7) find some examples of regular and irregular verbs. Revise the three forms of the verbs. What are they used for?**

*example:*

*regular: pass (passed, passed)*

*irregular: be (was/were, been)*



**Ex.9 To discuss Michael Faraday's biography and career, write 5 questions (of various types). Then practice with your partner asking and answering them.**

*examples: What kind of education did Michael's parents give him? Young Faraday read extensively, didn't he?*

## **GRAMMAR: PAST SIMPLE VS PAST CONTINUOUS**

**Ex.10 Read the beginning (a) and the ending (c) of a story. Put the verbs into the Past Simple or the Past Continuous tenses. Make up the middle part of the story (b).**

a) It (be) was a dull Sunday morning and the university building (be) empty. Tom (walk) along the corridor when he (hear) a strange noise. Tom (stop) and (look) around, then he (realize) that the noise (come) from behind the heavy iron door of the lab.

b) ...

c) After the police (arrive), the security officer (turn) towards Tom.  
"My apologies, sir", he (say) and (shake) Tom's hand.

## **LISTENING**

**Ex.10 What do you know about Lev D. Landau?**

**Ex.11 Listen to the talk about Lev Landau and complete the sentences with the missing information.**

1. As a child, Dr Landau was a mathematical .....
2. He received his .....at the age of nineteen.
3. Dr. Landau worked both in Russia and .....
4. He taught and influenced many outstanding.....
5. He received many prestigious ....., including the 1962 Nobel Prize in Physics.
6. .... was named after him.



Research Institute / fragment of the picture by Ivan Koulakov

## Module 2 Part 3

### A Story of One Discovery

*“To invent, you need a good imagination and a pile of junk.” — Thomas A. Edison*

#### WARM-UP

**Ex.1** What do you think a scientist needs to make a discovery or an invention? Discuss it with your partner and then in groups.

#### READING

**Ex.2** Read the text paying attention to the words in bold. Then answer the following questions:

- 1) What project did Fermi work on?
- 2) How does the process of fission work?
- 3) How was he able to achieve control over the chain reaction?
- 4) What event proved Fermi’s idea?
- 5) Can you give examples of the applications of his discovery?

#### Fermi Creates Controlled Nuclear Reaction

Enrico Fermi (1901-1954) left Italy in 1938 to receive the Nobel Prize for physics in Sweden. He never went back. He and his wife moved to the USA to **escape** Italy’s fascism and anti-Semitism.

Fermi realized that nuclear **fission** was accompanied by release of colossal amounts of energy from the **conversion** of mass into energy. When scientists convinced President Roosevelt of this, Fermi was **appointed** to head a research team as part of a secret project to develop an atomic bomb. Fermi’s task, however, was to create a controlled nuclear reaction; that is, to **split** the atom without creating a deadly **explosion**.

Theoretically, it was possible. During fission a neutron is fired at the atom's nucleus, which splits and ejects a neutron. This ejected neutron could split another nucleus, **releasing** another free neutron to split yet another, and so on: a **self-sustaining** chain reaction. If this chain reaction went too fast, it became an atomic explosion, but under control it could produce a steady flow of energy.

At the University of Chicago, Fermi worked with a team to find a way to control the chain reaction. He did this by setting up the equipment - atomic pile - so that he could **insert** a neutron-absorbing material into the midst of the fission process to slow it down or stop it altogether. He found that **rods** made of cadmium would absorb neutrons. If the chain reaction speeded up, the cadmium rods could be inserted to slow it down and could be removed to accelerate it again.

By the end of 1942, the team was ready for its first test. The equipment was set up in a squash court at the University of Chicago. It was December 2. The moment was tense: if their theories and experiments until now proved wrong, they could blow up half of Chicago. A few of the rods were pulled out, and the reaction began. More rods came out. The reaction was self-sustaining. The team could increase or decrease the energy **output** by **adjusting** the rods. Fermi's idea worked, and the first controlled flow of energy from a source other than the Sun was achieved. A coded message told the government of this success: "The Italian navigator has just landed in the new world."

Since then, Fermi's theory has been **expanded** and **refined**. Nuclear reactors have been built in many countries to supply energy for military uses such as nuclear submarines and civilian uses such as ordinary electricity. But incidents through the years showed the dangers of the process and of its **waste products**, and nuclear power lost much of its original popularity.

**Ex.3 Match these words from the text with their definitions. Find them in the text and check their meaning.**

<b>to adjust</b>	(v.) to change smth slightly to make it work better
<b>to appoint</b>	(v.) to assign, to formally choose for a job
<b>conversion</b>	(n.) a process of changing smth into a different state
<b>to escape</b>	(v.) to run away, to avoid
<b>to expand</b>	(v.) to become greater in size, number or importance
<b>explosion</b>	(n.) a sudden burst of energy, detonation
<b>fission</b>	(n) a process of splitting an atom to produce large amounts of energy
<b>to insert</b>	(v.) to put smth into smth
<b>output</b>	(n.) the power, energy, etc. produced by a piece of equipment
<b>to refine</b>	(v.) to improve or clarify (a theory)
<b>to release</b>	(v.) to set free, to allow to move freely
<b>rod</b>	(n.) a long, straight piece of wood, metal or glass
<b>self-sustaining</b>	(adj.) able to continue by itself
<b>to split</b>	(v.) to divide smth into two or more parts
<b>waste product</b>	useless substance that is produced during the process of making smth

## LISTENING

**Ex.4 Listen to an interview where a commentator is talking about the Nobel Prize. Then answer the questions.**

1. According to the speaker, what is the greatest reward for winning a Nobel Prize?  
A the money                      B the medal                      C the certificate                      D the honour
  
2. How are people nominated for the Prizes?  
A Alfred Nobel chooses them.  
B The committee chooses one of the members.  
C Institutions suggest people who have done outstanding work in their field.  
D They are voted for publicly on the Internet.
  
3. Why did Alfred Nobel decide to set up the Nobel Prizes?  
A He didn't know what to do with his money.  
B He wanted to do some good with his money.  
C He wanted to help scientists only.  
D He wanted to show people how rich he was.
  
4. How much money did Alfred Nobel give to set up the Prizes?  
A more than \$400,000  
B more than \$400,000,000  
C more than \$40,000  
D more than \$4,000,000
  
5. According to the speaker, which is true about the Nobel Prize winners?  
A Most of them are women.  
B Most of them are men.  
C Most of them are European.  
D Most of them are young.
  
6. There is NO Nobel Prize for  
A literature                      B physics                      C peace                      D mathematics

## MODULE 2

### GRAMMAR PRACTICE

#### Past Tenses

##### Ex.1 Use Past Continuous to complete the sentences.

- 1) - What you (do) yesterday at 15.00?  
- I (play) tennis and my brothers (listen to) music.
- 2) It (rain) when we went out.
- 3) While he (learn) to drive he had many accidents.
- 4) When we first met you were studying English.
- 5) Who (you talk) to as I came in? I (talk) to my new secretary.
- 6) Where was he living when you saw him last?
- 7) He (write) a composition when I saw him.

##### Ex.2 Read the following letter. The author went back to his hometown after many years and wrote this letter to his friend. Put the verbs into Past Perfect.

Dear Chris,

By the time I returned to New Baytown, many things had happened. My best friend, Tony, was no longer there when I came. He (go) away. By the way, the neighbors told me on the first day I came here that Mr. Jackson wasn't living in Oak street any longer. He (leave) too. You wouldn't recognize the Grand Street. They (change) everything there. But on the whole, I found the town much as it (be), green and quiet.

On the second day I went to see our school and it was still there, but they (add) a new wing. The bookshop where we used to buy textbooks and pens was no longer there. It (close) down. But they (build) a new bookshop not far from it and (open) a nice café in the old building where the bookshop (be).

Honestly, I was very pleased to see the place again. I (not/see) it for ten years, you know.

Yours,

Mike

##### Ex.3 Read the abstract from a biography. Put the verbs into Past simple, Past continuous, or Past Perfect.

- How did you hear of John Lennon's death?
- It (be) early in the morning and it (rain). I (work) at my office when I (get) a phone call. It (be) an American journalist who (tell) me that John (be killed). A fan (shoot) him in a hotel in New York. I (be) horrified. First, I (start) thinking, 'Will I be next?' But then I (realize) that it was the end of everything. When I (get) home that night I (cry).

## MODULE 2

### VOCABULARY PRACTICE

#### Word Formation

**Ex.1 What nouns correspond to the following verbs? Make some example phrases with these nouns.**

*Model: to argue / argument / a convincing argument / to put forward an argument*

to argue  
to assume  
to create  
to describe  
to develop  
to discover  
to formulate  
to introduce  
to invent  
to observe  
to obtain  
to propose  
to prove  
to publish  
to study

**Ex.2 Complete the word chains. Mind the parts of speech.**

\_\_\_\_\_ (v) - \_\_\_\_\_ (n) – discoverer (n)  
flaw (n) - flaw (v) – \_\_\_\_\_ (adj) - \_\_\_\_\_ (adv)  
\_\_\_\_\_ (v) – introduction (n) – introductory (adj)  
\_\_\_\_\_ (v) – \_\_\_\_\_ (n) – publisher (n)  
resist (v) - \_\_\_\_\_ (n) - \_\_\_\_\_ (adj)  
\_\_\_\_\_ (v) – foundation (n) – founder (n)  
equal (adj) - \_\_\_\_\_ (adv) – equate (v) - \_\_\_\_\_ (n)  
\_\_\_\_\_ (v) - \_\_\_\_\_ (n) – observatory (n) – observer (n)  
\_\_\_\_\_ (n) – scholar (n) – scholarship (n)  
\_\_\_\_\_ (v) - \_\_\_\_\_ (n) – expanding (adj) – expandable (adj)  
investigate (v) - \_\_\_\_\_ (n) – investigator (n) – \_\_\_\_\_ (adj)  
invent (v) – invention (n) - \_\_\_\_\_ (n) - \_\_\_\_\_ (adj)