

**KAZAN FEDERAL UNIVERSITY**  
**INSTITUTE OF SOCIAL AND PHILOSOPHICAL SCIENCES AND**  
**MASS COMMUNICATIONS**

*Department of Social Philosophy*

*Department of General Philosophy*

**N.O. KHAZIEVA, A.H. KHAZIEV, J.A. PILOTO RODRIGUEZ**

**THE EMERGENCE AND FORMATION OF SCIENCE:  
SCIENTIFIC UNDERSTANDING OF THE WORLD ORDER**

(Study guide)

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**Рецензенты:**

доктор философских наук, профессор кафедры социальной философии  
**КФУ Нуруллин Р.А.**

кандидат философских наук, доцент кафедры социальной философии КФУ  
**Иванова О.Г.**

Хазиева Н.О., Хазиев А.Х., Пилото Родригес Х.А.

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Учебно-методическое пособие «The emergence and formation of science: Scientific understanding of the world order» предназначено для бакалавров, магистров, аспирантов и всех, кто желает ознакомиться с процессами зарождения и развития западно - европейской научной мысли. Пособие представляет собой собрание текстов выдающихся мыслителей, ученых и писателей доклассической Древней Греции, раскрывающих наиболее значимые научные представления того времени о природе, обществе, человеке, а также содержит контрольные вопросы и тестовые задания для самоконтроля.

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## I. INTRODUCTION

The educational-methodological manual "The emergence and formation of science: Scientific understanding of the world order" includes the texts of prominent thinkers (scientists, writers and philosophers) of pre-classical ancient Greece, (revealing the essence and nature) of the most significant scientific concepts of that time. The four-part structure of the manual allows to focus the reader's attention alternately on the four main components that make up the worldview of a person in early Antiquity:

The world order, or the ancient understanding of the structure and functioning of the world, the Cosmos as an ordered harmonious whole, Society, as a recreated cosmic order on Earth, and Man, as an element of this order. Also, this structure of the manual allows you to trace the origin, development of science in general, and the formation of highly specialized branches of knowledge, from which astronomy, geology and geography, medicine, biology, logic, philosophy, jurisprudence and mathematics will develop over time. Of course, modern science in the form in which we know it is not the creation of exclusively Western European thought; here, of course, there is knowledge accumulated by both the Middle East and Asian countries. However, for the main, key branch of the development of science as a whole, it is supposed to begin with Antiquity.

The most ancient mythology and philosophy did not dismember the picture of the world: nature, man, deity are one in it. In general, a person in the ancient world order is only a material that contributes to the introduction to higher, impersonal values. Consciousness of this type, naturally, gravitates towards power, in which it expresses itself, as it is assumed, the sought absolute. Power is understood as an unconditional value, as the most complete expression of the mystery of being. It arises independently of a person as a reflection of the spirit of the Universe. A person must consciously submit to this power, not even pretending to comprehend its meaning. Here the individual is not considered as a value, on the

contrary, any uniqueness of a person is assessed as evil, as a hindrance. However, this domination of universality does not exclude the emergence of ethical principles of mercy, humanity, goodness, the awakening of a sense of self-awareness of the individual, and already in the period of late antiquity the word "fellow citizen" becomes not an empty phrase, but carries with it very important and sometimes heavy obligations.

At the end of each chapter, the reader is presented with questions, the answers to which contribute not only to repetition and consolidation of the studied material, but also make it possible to analyze the reasons for the emergence of interest or the need for a particular type of knowledge, allow, based on the material presented, to philosophize on topics of progressive or the downward movement of the development of ancient Greek (and, therefore, ours) thought.

This book is intended for bachelors and masters of both socio-humanitarian and natural science specialties of a higher educational institution; can be useful in the study of philosophy and history and methodology of science.

## II. GUIDELINES

To study the primary sources for this section, we recommend concentrating primarily on the following aspects:

- a) The beginning of existence,
- b) Ideas about the origin and destruction of the world,
- c) The structure of the world,
- d) The functioning of the world.

This approach allows us to represent the world order as a kind of integrity, obeying the laws of origin, functioning and transition to a different qualitative state.

The most ancient mythology and philosophy did not dismember the picture of the world: nature, man, deity are one in her. The whole man in antique the world order is only a material that contributes to the introduction to higher, impersonal values. Consciousness of this type, naturally, gravitates towards power, in which it expresses itself, as it is assumed, the sought absolute. Power is understood as an unconditional value, as the most complete expression of the mystery of being. It arises independently of a person as a reflection of the spirit of the Universe. A person must consciously submit to this power, not even pretending to comprehend its meaning. Here the individual is not considered as a value, on the contrary, any uniqueness of a person is assessed as evil, as a hindrance. However, this domination of universality does not exclude the emergence of ethical principles of mercy, humanity, goodness, the awakening of a sense of self-awareness of the individual, and already in the period of late antiquity the word "fellow citizen" becomes not an empty phrase, but carries with it very important and sometimes heavy obligations.

### III. ABOUT THE BEGINNING OF EXISTENCE

#### THALES

*Aristotle. Metaphysics, I, 3, 983 b 6.*

Most of the first philosophers considered the principles related to the category of matter to be the only principles of all things: from what all things consist, from what, as from the first, they arise and into what, as in the last, they are destroyed ... they believe this is an element and it is the beginning of things.

*Aristotle. Ibid. I, 3, 983 b 18.*

However, the quantity and type (εἶδος) of such a beginning (αρχή) are not all determined in the same way. So, Thales, the founder of this kind of philosophy, considers [the material principle] water (that's why he argued that the earth is on water). He probably deduced this view from the observation that the food of all [creatures] is moist and that heat as such is born from water and lives off of it, and "that from which [everything] arises" is, [by definition], and is the beginning of all [things]. That is why he accepted this view, and also because the sperm of all [living beings] is of a moist nature, and the origin and cause of the growth of moisture-containing [beings] is water.

#### ANAXIMANDER

*Simplicius. Commentary on Aristotle's Physics, 24, 13.*

Of those who posit one moving and infinite [beginning], Anaximander, son of Praxiades, Miletus, successor and disciple of Thales, believed the infinite (το άπειρον) to be the beginning and element of beings [things], first introducing this name of the beginning. He considers this [beginning] not water and not some other of the so-called elements, but some other infinite nature, from which the firmaments [worlds] and the cosmos located in them are born. "And from what

[began] things are born. ... .. the appointed time limit”, as he himself says about it in rather poetic words.

## **ANAXIMENES**

*Opinions of philosophers, I, 3, 4 ("On the beginnings") // Fragments of early Greek philosophers. Part 1, p. 134.*

Anaximenes, the son of Eurystratus, a Miletus, argued that the beginning of beings is air, because from it everything is born and into it again decomposes. “As our soul,” he says, “which is air, holds us together, so breath and air embrace the entire cosmos” (“air” and “breath” [here] are used synonymously). He is also mistaken, believing that animals consist of simple and homogeneous air or pneuma, for there cannot be one principle of all things - matter, but it is also necessary to accept the creative cause. So, [one] silver is not enough for it to become a goblet, if there is no creative reason, that is, the Silver Works of the master; the same is true for copper, wood, and [any] other material.

## **PYTHAGORAS**

*Aristotle. Metaphysics, Book 1, 5, 985 - 986.*

In other works, we talked about this in greater detail.

Here we want to establish what kind of principles they believe, how these principles return to the realm of the causes that we talked about. They consider number to be the beginning not only as a constitutive material for beings, but also as forming the properties and status of beings.

## **PARMENIDES**

*Aristotle. Physics. A 5, 986 b 27.*



Parmenides appears to be making more discerning judgments. He postulates that the non-existent is nothing different from the existing ["that which is"], from which, as he believes, it necessarily follows that there is [only] one thing - the existing ["that which is"] and nothing else. ... However, forced to reconcile [theory] with experience [own. "Phenomena"] and believing [therefore] that [what is] is one according to the Logos, but multiple according to sensory perception, he, on the other hand, believes that there are two reasons and began two: hot and cold, i.e. e. fire and earth. Of these, he correlates the hot with the existing ["that which is"], and the cold with the non-existent ["that which is not"].

*Simplicius. Commentary on "Physics", pp. 25, 15. // Fragments of early Greek philosophers. Part 1.P. 281.*

Of those who believed in a finite number of principles, some accept two, as, for example, Parmenides in "Doxa" fire and earth, or rather, light and darkness.

## **EMPEDOCLES**

*Lucretius. On the nature of things, 1, 714 pp.*

... Or takes four elements as the basis of everything,

Namely: earth, fire, breath of air, moisture,

The first of the first among them is Empedocles of Akragant,

Whom an island raised on the triangular shores,

That Ionian waves wash around and bitter

The salt of the green ramparts irrigate its coast,

Striving by a narrow strait, and sweep along the coast,

Borders separating it from the Italian land.

Wild here and Charybdis, and here deaf rumblings

Fiery Etna threatens to burst with accumulated anger,  
So that, belching out a mighty flame again from the throat,  
Again she lifted up fiery lightning to heaven.  
But, although many miracles appear to the human eye  
In this country, and it is reputed to be worthy of a visit,  
Full of all kinds of riches, strengthened by the strength of the people,  
There was nothing in her that was worthy of this husband.  
And he would have turned out to be more precious, holy and glorious.  
And his chants from the depths of the inspired heart  
They sound so loud, set out such discoveries,  
One cannot even think that he was born of a mortal root.

*Opinions of philosophers (Pseudo-Plutarch), I, 3, 20 ("About the principles that they are") // Fragments of early Greek philosophers. Part 1.P. 356.*

Empedocles, son of Meton, acragantes, posits four elements: fire, air, water and earth - and two forces as driving causes: Love and Strife, the first of which unites, and the second divides ... Zeus he calls ardor (ζέσις) and ether, the Life-giving Hero — air, Aidoneus — the earth, and Nestida — a human spring — as it were, sperm and water.

## **Control questions**

1. What are the ancient Greek ideas about the beginning?
2. What can be the reason for such a variety of origins?
3. What ontology and epistemology can arise from such ideas about the beginning?

## IV. IDEAS ABOUT THE ORIGIN AND DESTRUCTION OF THE WORLD

### THALES

*Heraclitus the allegorist. Homeric questions, 22. // Fragments of early Greek philosophers. Part 1., P. 110.*

Wet substance, easily transforming [own. "Climbing over"] into all kinds of [bodies], it takes on a variegated variety of forms. The evaporating part of it turns into air, and the thinnest air ignites in the form of ether. As it precipitates and turns into silt, water turns into earth. Therefore, of the quaternary of elements, Thales declared water to be the most causal element. Who gave birth to this view? Isn't Homer who said, "Ocean, etc."?

### ANAXIMANDER

*Simplicius. Commentary on Aristotle's Physics, 24, 13.*

... It is clear that, having noticed the interconversion of the four elements, he did not consider any of them worthy to be mistaken for the substratum [of the others], but [recognized as the substratum] something different, different from them.

He explains the emergence not by the otherness [= qualitative transformation] of the primary element, but by the separation of opposites as a result of perpetual motion. Therefore, Aristotle and put him on a par with philosophers such as Anaxagoras.

*Opinions of philosophers, I, 3, 3 // Fragments of early Greek philosophers. Part 1, S. 119-120.*

Anaximander, the son of Praxiades, a Miletus, considers the infinite to be the beginning of beings: from it everything arises and everything is destroyed in it.

Therefore, infinite [in number] cosmos are born and again destroyed into that from which they arose. He explains why it is limitless (ἀπέραντον): so that the present arising never runs out. But he is mistaken, not saying that there is infinite: whether it is air, or water, or earth, or what other bodies. He is mistaken in what he says about matter, and abolishes the creative cause. After all, the infinite is nothing else but matter, but matter cannot be reality if a creative cause is not given. Wed: Aristotle. Physics, G 7, 207 b 35: It is clear that the infinite should be attributed to the category of a material cause, that it is not a substance, [but an attribute, moreover] a negative attribute [= deprivation], a self-existent substrate [whose attribute is infinite] is sensual continuum.

It is quite obvious that all the other [philosophers] considered the infinite (τὸ ἀπειρον) as matter (ὕλη), and therefore it is absurd to assume that it is encompassing (τὸ περιέχον) and not encompassing. Ibid., 8, 208 a 8: In order to explain the inexhaustibility of arising, there is no need to postulate an actually existing infinite sensory body, since the destruction of one thing can be the arising of another, while the Universe is finite.

*Cicero. On the nature of the gods, I, 10, 25.*

According to Anaximander, gods are born: they arise and perish after long periods of time, and at the same time they are countless worlds. But how can we think of God otherwise than eternal?

## **ANAXIMENES**

*Simplicius. Commentary on Aristotle's Physics, 149, 28. Ibid. P. 130.*

[In the commented passage - 187 a 12 - Aristotle ascribes the doctrine of "condensation and rarefaction" to all material monists, cf. 12 A 16]: Some give rise to the rest [bodies] from the material One, [differentiating it] by rarefaction and density. So, Anaximenes says that, thinning, the air becomes fire, thickening - the

wind, then - a cloud, then, [thickening] even more - water, then earth, then stones, and from them - everything else. Theophrastus in his "[Natural] History" ascribed rarefaction (μάνωσις) and condensation (πύκνωσις) to him alone. It is clear, however, that others also used sparseness and density: after all, Aristotle said about all of them together that they "give rise to the rest [bodies] by density and rarefaction, producing a multitude."

*Hippolyte. Refutation of all heresies, I, 7, 1. Ibid. S. 130-131.*

Anaximenes, also a Miletus, the son of Eurystratus, believed that the beginning is the endless air (αήρ άπειρος), from which is born what is, what was and what will be, as well as gods and divine beings, and [all] other [things] - from his descendants.

*Cicero, M.T. On the nature of the gods, I, 10, 26.*

Then Anaximenes believed that air is a god, that he is born, immeasurable and endless and always in motion. As if devoid of any form whatsoever, air can be a god, while it is especially fitting for God to possess not only some, but the most beautiful image, and as if everything that was born is not doomed to death!

*Opinions of philosophers (Stobey), I, 7, 13 ("What is God?") // Fragments of early Greek philosophers. Part 1, p. 131.*

Anaximenes: air. {By such expressions one should mean forces penetrating elements or bodies.}

## **PYTHAGORAS**

*Aristotle. Metaphysics, Book 1, 5, 985 - 986.*

They call even and odd numbers as elements of the number, the last of them is the limiting, and the first is infinite. One comes from both elements, it is even

and odd together. From the One comes the number, and the numbers, as already mentioned, form the entire universe.

## **HERCLITUS**

*Diogenes Laertius. On the life, teachings and sayings of famous philosophers, p. 334.*

In general terms, his opinions were as follows. Everything is made up of fire and is permitted into fire. Everything is done according to fate and is harmonized by mutual opposition (enantiodromia). Everything is filled with souls and demons.

*Hippolyte. Refutation of all heresies, I, 7, 1 // Fragments of early Greek philosophers. Part 1.P. 180.*

He argued that he himself knows everything, and other people know nothing. His statements almost completely agree with Empedocles: he also argued that the beginning of everything is enmity and love, that God is an intelligent fire, that everything moves in opposite directions and is worthless.

Empedocles believed that the space around us is full of evil, and evil extends from near-earth space to the moon, and does not go further, since the entire space above the moon is cleaner. And Heraclitus thought the same.

## **PARMENIDES**

*Alexander of Aphrodisia. Commentary on "Metaphysics", A 3. 984 b 3 Ibid. P. 218.*

About Parmenides and his teachings Theophrastus in the first book "On Physics" says: "Who appeared after him (he means Xenophanes) Parmenides, the son of Piretus, an Elean, went both ways: he claims that the universe is eternal, and tries to interpret the genesis of things. In both cases, his views are not the same: in

accordance with the truth, he considers the universe to be single, unarisen and spherical, and in accordance with the opinion of the crowd, in order to interpret the genesis of the phenomenal world, he posits two principles: fire and earth, one as matter, the other as a creative reason ”.

*Aristotle. About the sky. G 1, 298 b 11.*

Those who philosophized in search of truth before us disagreed in their views [regarding the emergence] and with those views that we now express, and among themselves. Some of them completely denied origin and destruction: nothing that exists, they argue, does not arise or is destroyed - it only seems to us. Such are Melissa and Parmenides with their supporters. Their theories, even if they are in many respects correct, cannot nevertheless be considered natural sciences, since the question of the existence of objects devoid of arising and completely immovable things should be considered not by physics, but by another discipline that takes precedence over it. And they believed that apart from the existence of sensibly perceived things, there is no other reality, but at the same time they understood for the first time that without this kind of [= unchanging] things, no cognition or thinking is possible, and therefore transferred to the first [= intelligible] those views that were true for the second [= sensual].

## **EMPEDOCLES**

*Diogenes Laertius. On the life, teachings and sayings of famous philosophers, p. 325.*

His opinions were as follows. There are four bases - fire, water, earth, air; and also the Friendship by which they are united, and the Enmity by which they are separated. Here are his words:

The radiant Zeus, and Aidoneus, and the living Hera,

Also Nestida, flowing with tears in the mortal streams...



where Zeus he calls fire, Hero - earth, Aidoneus - air and

Carry milk - water. And he says:

This continuous exchange cannot be stopped in any way,

that is, this routine is eternal. And he adds:

That, attracted by the Friendship, all comes together,

That hated Enmity again chases apart from each other.

*Simplicius. Commentary on Physics, pp. 158, 1-159. // Fragments of the early  
Greek philosophers. Part 1.S. 344-345.*

I will say two things: then One grows up to be the only one

Out of many; it disintegrates again to be many of the One.

The birth of mortals [things] is twofold, death is twofold:

One of them generates and destroys the convergence of all [roots];

5 The other flies apart, torn apart as they separate again,

And they [= elements] never stop continuous

alternations

Then by the action of Love they all converge into One,

Then, under the influence of fierce Hatred, everyone rushes apart.

And since each time they form a set anew after

dividing One,

10 In so far as they are born and their age is fickle,

And since they never stop alternating,

Insofar as they exist eternally, motionless in a circle.

Heed my words, because learning nurtures the mind.

As I said before, heralding the boundaries of the story,

15 I will say in two ways: the One grows up to be the only one,

Of the many, it decays again to be many of the One,

By Fire, Water, Earth and the untold heights of Ether,

The accursed Hatred apart from them [= the elements], completely  
balanced,

And Love in them, equal in length and width.

20 Behold it with your mind and do not sit with amazed eyes.

It is she who is worshiped by mortals, inborn to the genitals,

From her they feel love thoughts and do deeds of friendship,

Calling her by the name of Gefosina (Joy) and Aphrodite.

Although it winds [= abides in them], no mortal

Human; did not know her with his eyes,

25 You listen to the immutable course of [my] speech.

All of them [= elements] are equal [among themselves] and are of the same age  
by birth.

But each fulfills his honorary position, each is inherent  
original disposition (ethos),

And they dominate in turn after a certain period of time.

And nothing is added to them, nothing is taken away from them:

30 For if they continuously suffered damage, they would no longer exist,

But what would then give the growth of this Universe, and where would it come from?

And how [or: "where"] would have disappeared, since nothing is empty of them [= they are all full]?

Not! They are the same [or: "they are the same"], but running each other through a friend

They become one thing or another, remaining continuously and eternally identical [to myself].

*Pseudo-Aristotle. About Melissa, Xenophanes, Gorgias, 2, 6, 975 a 36. Ibid. P. 345.*

Further, even if neither the emergence of non-existent, nor the destruction of existent are absolutely impossible, what prevents, as Empedocles believes, that some [existent] were arisen, and others - eternal? After all, he [Empedocles] too, having accepted all these [postulates of Melissa], namely that, nevertheless, he asserts that some of beings are eternal - fire, water, earth and air, while others arise or have arisen from them. No other emergence, [except for emergence from the elements], as he believed, is impossible for beings, the emergence of eternal [elements] and beings does not occur in relation to essence, since he believed that this is impossible ... Much arises by mixing and combining fire and the opposite him [the elements], but is destroyed by their separation and separation. Thus, much exists as a result of mixing and separation, and by nature there are four [beings], not counting the [driving] causes, or One.

*Aristotle. On the origin and destruction, B 7, 334 a 18 ff., 26 ff.*

Those who do not recognize the emergence of [elements] neither from each other, nor [all] from one, but only in the sense in which the wall is made of bricks, are unable to explain how meat, bones and whatever else. And how will those who believe like Empedocles explain [the emergence]? They have to accept a [mechanical] connection by necessity, just as a wall is [made up] of bricks and stones. But this mixture will consist of elements that have retained their quality, but juxtaposed side by side in the form of small particles: this is how meat and any other body [will look like].

*Plutarch. On the initial cold, ch. 16. 952 V. // Fragments of the early Greek philosophers. Part 1.P. 371.*

It seems that water by itself and initially cold ... and in general fire has the property of separating and separating, and water - to glue and hold together, as it binds and squeezes due to moisture. Therefore, Empedocles gave us an allegorical interpretation, calling each time fire "disastrous Strife", and moisture "binding Love".

### **Control questions**

1. Ancient Greek ideas about the beginning and end of the universe.
2. About what forces contributing to the emergence and destruction the world, say the thinkers?
3. Draw parallels between the results of modern research on the origin and alleged death of the Universe and the ancient Greek understanding of these processes.

## V. ABOUT THE STRUCTURE OF THE WORLD

### THALES

*Opinions of philosophers, I, 3 ("On the beginnings") // Fragments of early Greek philosophers. Part 1, p. 109.*

Thales of Miletus argued that the beginning of things [things] are water. (This husband is considered the founder of philosophy, and the Ionian school was named after him: after all, there were many philosophical successions. After studying philosophy in Egypt, he returned to Miletus older.) Everything is from water, he says, and everything decomposes into water. He concludes [about this], first, from the fact that the beginning (αρχή) of all animals is sperm, and it is wet; so all [things] probably originate from moisture. Secondly, from the fact that all plants feed on moisture and [from moisture] bear fruit, and those deprived [of it] dry up. Thirdly, from the fact that the fire of the Sun and stars itself is fed by water vapor, as well as the cosmos itself. For the same reason, Homer expresses the following judgment about water: "The ocean, which is the progenitor of all."

### ANAXIMANDER

*Simplicius. Commentary on Aristotle's Physics, 150, 24.*

The opposites are: hot, cold, dry, wet and other.

*Simplicius. Ibid., 27, 11.*

These statements of Anaxagoras, according to Theophrastus, are similar to those of Anaximander: in fact, he says that when the infinite is divided, homogeneous [bodies] move towards each other, and, since there was gold in the universe, gold appears, and since the earth is earth and in the same way, all other bodies, insofar as they do not arise, they say, but are initially contained [in the mixture]. But only Anaxagoras [unlike Anaximander] established the Mind as the

cause of movement and arising: under its action [the elements] split and gave rise to the cosmos and the nature of the rest [of beings]. Based on this, etc.

*Simplicius. Ibid., 154, 14.*

Theophrastus adjusts Anaxagoras to match Anaximander and interprets Anaxagoras' words in such a way that they mean that he considers the [material] substrate to be one nature. This is what he writes in Natural History: "Based on this, it must be assumed that the material principles, as said, he recognizes as infinite [in number], and the cause of movement and emergence - one. If we take the mixture of all things as one nature, indefinite in form [= qualitatively] and in magnitude - and this, apparently, is the meaning of his words - then it turns out that he posits two principles - the nature of the infinite and the mind, so that bodily he obviously interprets the elements quite similarly to Anaximander."

*Simplicius. Ibid., 479, 30.*

Having shown that no natural body composed of many [bodies] can be infinite, he then shows that in the same way there cannot be one simple infinite body. Indeed, if the [infinite body] were simple, it would be either one of the four elements, or something different from them, as Anaximander and his followers believe [taking for an infinite] para-elemental [body], from which they spawn elements. That the infinite cannot be one of the elements is clear, among other things, from the fact that Anaximander, desiring that his [first] element be infinite, identified him not with air, fire or any of the four elements, since the latter are among themselves in the relationship of opposites, and if one of them was infinite, the opposites [to him] would be destroyed by him. And the fact that the para-elementary infinite [body], posited by the beginning, not only is not infinite, but does not exist at all, he shows, proceeding from the premise that everything that arises from something is decomposed into it, as observation shows. Therefore, if

the emergence took place from that body [other than the elements], then, in addition to the four, there would be something else in which decomposition would take place. However, nothing of the kind is observed here.

## **ANAXIMENES**

*Simplicius. Commentary on Aristotle's Physics, 22, 9. // Fragments of early Greek philosophers. Part 1, S. 129-130.*

It should be noted that one thing is infinite and finite in terms of a set (this [concept of infinite] was inherent in those who posit a set of principles), another thing is infinite or finite in terms of [extended] value (ἀπειρον κατά μέγεθος): this [concept] he [Aristotle] explores in polemics against Melissus and Parmenides, it also applies to Anaximander with Anaximenes, who adopted one, but at the same time infinite in [extended] size element.

## **PYTHAGORAS**

*Aristotle. Metaphysics, Book 1, 5, 985 - 986.*

The Pythagoreans argued that there are only ten principles, divided into opposites: 1. limit-infinite, 2. odd-even, 3. one-many, 4. right-left, 5. male-female, 6. resting-moving, 7. straight-curve, 8. light-dark, 9. good-vicious, 10. square-elongated.

Alcmeon of Croton thought in the same way, so either he borrowed the teachings from the Pythagoreans, or they from him. Alcmaeon entered the period of maturity, when Pythagoras was already old, and his theory is very similar to the Pythagorean. Most of human properties form pairs of opposites, only, unlike other Pythagoreans, he believed that they are grouped in a random way. For example: white-black, sweet-bitter, good-wicked, big-small. He spoke vaguely about the

remaining oppositions, although the Pythagoreans indicated exactly how many opposites and what they are.

From both points of view, we can conclude that the principles of existence are the essence of opposites. But even the Pythagoreans did not analyze these opposites so much that it was possible to establish how to reduce them to the reasons that we talked about. It seems that they ascribed to the elements the function of matter, in fact, they said that the substance consists precisely of these elements, which are inherent in it.

*Philolaus, fr. 2. // Western philosophy from its origins to the present day.  
Antiquity and the Middle Ages (1-2). P. 41.*

Everything needs to be either limited or unlimited, or both limited and unlimited. There cannot be only infinite and only finite. From this it follows that existing things cannot be formed only from the elements of limitation, as well as only from the elements of infinity, it is obvious that the cosmos and things that exist in it are formed through the harmony of finite and infinite elements.

## **HERACLITUS**

*Hippolyte. Refutation of all heresies, IX, 9, 1 // Fragments of early Greek  
philosophers. Part 1, S. 189-190.*

Heraclitus says that everything divisible is indivisible, born unborn, mortal is immortal, the Word is Eon, Father is Son, God is justice...

That the Word exists eternally, wholly and always existing, he says:

"This is the Word that exists forever ... as they are." The same thing that it is a child, completely and forever eternal king of all things, he says this...



## PARMENIDES

*Pseudo-Plutarch. Stromats, 5. Preparation for the Gospel, I, 8, 5. Ibid. P. 278.*

Parmenides of Elea, a student of Xenophanes, assimilated his views, but at the same time took the opposite position. He argues that, according to the truth of things, the universe is eternal and immovable: in his words, it is one, only begotten, unshakable and unborn. And the emergence (genesis) of imaginary-existent-according-to-false-subjective-representation, as well as sensations, he expels from [the sphere of] truth. He says that if there is something besides that which is ["that which is"], then it is not that which is ["that which is"]. But the non-existent ["that which does not exist"] does not exist in the whole totality of things.

So he comes to the assumption that the being ["that which is"] did not arise [of its own. "Devoid of genesis"]. The earth, he said, arose from the deposition of thick air.

*Aristotle. In the same place. G 6, 207 a 9.*

We define the whole as follows: "that in which nothing is absent," for example, a whole person or a whole box. [This definition is applicable] both to a single [whole object] and [to the whole] in the proper sense [= the World Whole], that is, to the "whole, outside of which not one [of its parts] is located" ... And where something is absent [and is] outside of it, that is not the whole, whatever is absent. Whole and perfect [finished] are either completely identical or close in meaning. But nothing can be perfect without an end, and the end is a boundary. Therefore, we should assume that Parmenides spoke better than Melissa: Melissa says that the infinite is the whole, and Parmenides - that the whole is limited "from the center is equivalent."

*Simplicius. Commentary on Physics, p. 115, 11. // Fragments of early Greek philosophers. Part 1.S. 280-281.*

According to Alexander, Theophrastus, in his first book, Investigations of Nature, expounds Parmenides' argument as follows: "That which is different [letters, 'apart from'] from being is non-being. Non-existent nothing. Therefore, existence is one. "And Evdem is like this: "That which is different from being is not-being. But existence is unambiguous. Therefore, existence is one. "Whether Evdem really writes about this with such clarity elsewhere, I cannot say. But in Physics, he writes the following about Parmenides, and from his words, perhaps, one can deduce [the formulation of Eudemus quoted by Alexander]: ] "being" is used in one sense, with the exception of the category of what is, for example, when [the predicate] "person" refers to individuals. And when concepts are predicted about the individual, all [individuals] will have the same concept of being, just as the concept of an animal is inherent in all animals. Let us assume that all beings are beautiful and it is impossible to find a single one that is not beautiful: all [that are] in this case will be beautiful, but the beautiful will not be one, but many: the color will be "beautiful", the occupation will be "beautiful", " beautiful "- whatever you want. In the same way, all things will be "existing", but "existence" will not be one or the same: water is one thing, and fire is another. Therefore, it is not surprising that Parmenides followed unreliable arguments and was misled by the fact that in his time it was not yet clear: no one had a clue about the polysemy [of existence], only Plato first introduced the distinction of two meanings; no one distinguished between substantively existing and incidentally existing. Obviously he was deceived by this. This theory [= categorical analysis of things], as well as syllogistics, was discovered [later] thanks to disputes and dialectics [proper. "Theses" and "antitheses"], because [thesis] was not recognized by [the opponent] if it did not seem [logically] necessary. And the former philosophers presented their theses without proof."

*Hippolyte. Refutation of all heresies, I, 11, 1. Ibid. P. 278.*

Parmenides believes that All is one, eternal, did not arise and spherical, but he did not escape the opinion of the majority, believing that the principles of All are fire and earth: earth as matter, fire as a creative cause. He said that space is being destroyed, but he did not say how. (2) He also argued that Everything is eternal, has not arisen, is spherical and the same, has no space within itself, is motionless and finite.

Plato. Feast 195 with A in the ancient feuds of the gods, which Hesiod and Parmenides talk about, Necessity rather than Love [Eros] is guilty. If there was Love in them, they would not castrate, they would not put each other in chains and would not commit many other violence.

*D. Antiseri, J. Reale. Western philosophy from its origins to the present day.*

*Antiquity and the Middle Ages. S.47-49.*

Parmenides "On Nature".

There is only one mental path left

[Which reads]: "There is." There are a lot of signs on it,

That existence is unborn, it is not subject to destruction,

Whole, only begotten, roadless and complete.

It was not once and will not be, since it is one and is now,

One and continuous. For what kind of birth will you seek for him?

How and where did it grow from? From non-existence? This I will not allow

For you to express or think, for you can neither express nor

to think:

"Do not eat". And what necessity would have prompted him

Rather later than before, starting from scratch, to be born?

Therefore, it should always or never.

As well as from existence the power of certainty will never allow

To be born to something other than himself. That's why

Dike did not let [existence] be born or perished, loosening the shackles,

But it holds tight. The lawsuit in this case is as follows:

To eat or not to eat? So the verdict was passed, as required

necessity, From one to refuse, as unthinkable and

nameless, for it is not true

The path, while the other is recognized as existing and true.

How could what is now be later?

How could it be in the past?

If it was, then it is not, just as if it has no time

just to be.

So the birth died out and the death disappeared without a trace.

[...]

It [being] is indivisible, for everything is the same everywhere,

And here there is no more of him, but [over there] no less,

Which would exclude its continuity, but everything is filled with existence.

Thus, everything is continuous: for the being adjoins the being.

[...]

Immobile, within the bounds of great fetters,

It is beginningless and unceasing, since birth and death

Thrown away: they were repelled by unmistakable proof

Remaining the same and in the same place, it rests on its own.

Remains in the same state, for the irresistible Ananke

Keeps him bound within the bounds that, by locking, embracing,

Because existence cannot be incomplete.

For it does not need anything, and if it needs, then everything.

[...]

One and the same thing - thinking and what thought is about, For without being,  
oh

to which it is expressed, You will not find thinking.

For there is and will not be anything, Except that which exists, since Moira has  
chained

his

Be whole and still. Therefore, the [empty] name would be

all,

What mortals have established [in the tongue], convinced of the truth of this:

To be born and to perish, to be and not to be, Change place and change your  
bright color.

[...]

Since there is an extreme border, it is over

From all sides, like a lump of a perfectly round ball,

At each point equidistant from the center, for there is no need,

So that here it would be more or less than there.

For there is not nothingness that would make him stop gravitating

To the homogeneous, not such a thing that

Here it has become more, and there it is less than that which exists, for it is completely and inviolable.

For equal to itself from all sides, it is homogeneous within its own borders.

## **XENON**

*Diogenes Laertius. About the life, teachings and sayings of famous philosophers.*

*P. 341.*

His opinions are as follows: worlds exist, but emptiness does not exist; the nature of all things came from warm, cold, dry and wet, transforming into each other; people came from the earth, and their souls are a mixture of the above principles, in which none of them is dominant.

*Simplicius. Commentary on Physics, 139-140, 19, 24. // Fragments of early Greek philosophers. Part 1.P. 303.*

According to Themistius, Zeno's argument seeks to prove that existence is one, proceeding from the fact that it is continuous and indivisible. "If it were divisible," says [Zeno's argument according to Themistius], "then it would not be one in the strict sense due to the divisibility of bodies to infinity." But Zeno himself, apparently, said that [in this case] it would not be plural.

[...]

However, Porphyry also ascribes the argument from the dichotomy to Parmenides, who tries to prove from it that there is one. He writes: "Another

argument of Parmenides sought to prove by means of dichotomy that existence is one and only and at the same time has no parts and is indivisible. "If it is divisible," he [Parmenides] says, "let us divide it in two, and then each of the two parts [again] in two, and if we repeat this [dichotomous division] all the time, then either some limiting values will remain, the smallest and indivisible, and are infinite, so that the universe will be made up of the smallest, the number of infinite [quantities], or [existence] will disappear without a trace, and decompose into nothing, and will turn out to be composed of nothing, however, both are absurd "Therefore, [existing] is not divided, but one abides. In addition, if it is divisible, then, since it is uniform everywhere [letters, "like"], it will be equally divisible everywhere, and not something: here it is divisible, but not there. In that case, let's say it split everywhere [= at every point]. It is clear again that nothing will remain, but [existence] will disappear without a trace, and if it does consist [of certain parts], it will again consist of nothing. For if something remains, it will no longer be "divided everywhere." So from this it is also clear, he says, that existence is indivisible, devoid of parts and one thing. "

[...]

It is quite possible that in the above words of Porphyry the argument from the dichotomy, proving the indivisibility and unity of [existence] by reducing the assumption of its divisibility to absurdity, is quoted literally, is quite possible. It should be noted, however, whether this argument really belongs to Parmenides, and not Zeno, as Alexander believes. Indeed, in the work of Parmenides nothing of the kind is said, and the historical tradition in most cases ascribes the aporia "dichotomy" to Zeno. By the way, in the treatise on movement she is also referred to as Zeno.

*Philopon. Commentary on Physics, 42, 9. Ibid. S. 304-305.*

Opposing those who ridiculed the view of his teacher Parmenides, who believed that existence is one, and defending the views of the teacher, Zeno of Elea

undertook to prove that in reality [letters, “among beings”] there cannot be many. If there is a set, he says, then since the set consists of many [properties. “More than one”] units [genad], then by necessity there must be many [“more than one”] units, of which the set consists. Therefore, if we show that there cannot be many units, then it is clear that there cannot be a set, since a set is made of units. If there cannot be a multitude, and yet it is necessary that there be either one or a multitude, but there cannot be a multitude, then it remains that there is one. How did he prove that there cannot be many [more than one] units? Since those who admit a set confirmed this on the basis of evidence (there is a horse, a person, and any single thing, the totality of which makes up a set), Zeno, wishing to refute the evidence sophistically, argued that if a set consists of these things, and a set consists of units, then , these things are units. Therefore, if we show that they cannot be units, then it is clear that what consists of them will not be a set, since the set is made of units.

He proves it this way: Socrates, he says, whom you consider to be a unit that forms a multitude along with other units, not only Socrates, but also “white”, “philosopher”, “pot-bellied” and “snub-nosed”. Thus, the same person will be one and many. However, the same one cannot be one and many, therefore, Socrates is not one. And in the same way, all the other things of which you say many are composed.

But since there cannot be many units, it is clear that there cannot be many. But if existence by necessity must be either one or many, and meanwhile it has been proved that it is not many, since there are not many units, then it necessarily follows that [existing] is one.

He proves the same [by argument] from continuous. Let us assume that the continuous is [something] one. But since the continuous is divisible to infinity, the result of division can be divided into a larger number of parts each time. And if so, then it follows that continuous is plural. Therefore, the same will be one and many, which is impossible. Therefore, it cannot be alone. If nothing continuous is one,



and yet a set of necessity can be only if it consists of units, then since, consequently, there cannot be a set.

*Aristotle. Metaphysics, B 4.1001 b 7.*

Further, if one-in-itself is indivisible, then, according to Zeno's postulate, it will be nothing, for that which does not increase if it is added, and does not decrease if it is taken away, he says, does not belong to beings, descending in an obvious way from the premise that being is magnitude. And if it is a magnitude, then it is bodily, for only the body is all-round [= in all dimensions] that exists. Other [quantities], such as a plane and a line, will in some sense increase, if they are added, in some sense they will not, and the point and unit [monad] will not in any sense.

## **EMPEDOCLES**

*Sextus Empiricus. Against Scientists, VII, 115 pp., 120-126. // Fragments of early Greek philosophers. Part 1.S. 341-342.*

Empedocles of Acragas, according to those who claim a simpler interpretation of his teachings, teaches about six criteria of truth. Namely, assuming two active principles of all things - Love and Hate - and at the same time mentioning four as material (earth, water, air and fire), he recognized them as the criteria of all things. As I said above, the idea that like is cognized through like is very ancient, it has become commonplace among natural philosophers from time immemorial, and Democritus claimed to have given it an explanation...

... Apparently, Empedocles also follows this idea and asserts that since there are six principles that make up all things, then there should be an equal number of criteria [for the cognition of things, when he writes, making it clear that we

comprehend the earth through participation earth, water - due to participation in water, air - due to participation in air and, accordingly, in the case of fire. Others, however, argued that the criterion of truth, according to Empedocles, is not sensory sensations, but the correct mind.

There are two kinds of correct minds: one is divine, the other is human; of these, the divine is inexpressible, and the human is expressible. He says that the criterion of truth is not in sensations, but that the truth is not completely incomprehensible, but comprehensible to the extent of the reach of the human mind, he explains, adding to the above verses.

### **Control questions**

1. The ideas of the ancient Greeks about the structure of the world.
2. What happened to such ideas about the world order in the era of classical antiquity and beyond?
3. How similar are modern and ancient Greek ideas about the structure of the Universe, the composition of the planets, etc.?

## VI. ABOUT THE FUNCTIONING OF THE WORLD

### THALES

*Simplicius. Commentary on Aristotle's Physics, 22, 21. // Fragments of early Greek philosophers. Part 1, p. 110.*

Of those who believe one moving principle (they [Aristotle] calls physicists in the proper sense of the word), some consider it finite, such as Thales, son of Examia, Miletez, and Hippon [Ch. 38], who is considered an atheist. They believed that the beginning is water, moreover, sensory perception led them to this. So, the warm lives off the moist, the dying dries up, the sperm of all [living beings] is wet, all food is saturated with juices. And what each [creature] consists of, that is what it feeds on. Meanwhile, water is the basis (αρχή) of every liquid and that without which no [creature] can exist. Therefore, they took water as the beginning of everything and announced that the Earth rests on water.

### ANAXIMENES

*Simplicius. Commentary on Aristotle's Physics, 24, 26. Ibid. P. 129.*

Anaximenes, the son of Eurystratus, a Miletus, who was a disciple of Anaximander, just like him, believes that the substrate natural substance is one and infinite, but unlike him [considers it] not indefinite, but [concretely] definite, assuming it air.

He reduced the essential differences to rarefaction and density. Cutting apart, [the air] becomes fire, thickening - the wind, then a cloud, [thickening] even more - water, then earth, then stones, and from them - everything else. He, like Anaximander, considers movement to be eternal and considers it to be the cause of change.

*Hippolyte. Refutation of all heresies, I, 7, 1. Ibid. S. 130-131.*

(2) The property (εἶδος) of air is as follows: when it is extremely even [balanced, uniformly averaged, ομαλός], it is not visible to the eye, but reveals itself [when it becomes] cold, warm, damp and moving. He always moves, for if he did not move, then everything that changes would not change. (3) Thickening and thinning, [air] acquires visible differences. Thus, having spread [- scattered] to a more rarefied state, it becomes fire; in a neutral [letters, "middle, intermediate"] state, it returns to the [nature of] air; as it thickens from the air by "felting" a cloud is formed, thickening even more, [it becomes] water, even more - earth, and having reached the maximum density - stones. Thus, the most important [principles] of arising are opposites: hot and cold...

## **EMPEDOCLES**

*Philopon. Commentary on "On the origin and destruction", p. 19, 3. Ibid. P. 350.*

Now Aristotle again attacks Empedocles separately for the fact that he contradicts both phenomena and himself. He contradicts phenomena by the fact that he abolishes a qualitative change, although it is obvious, but to himself - because, on the one hand, he assumes the elements are unchanged and asserts that everything arises from the elements, while they themselves do not arise from each other; however, on the other hand, he says that under the domination of Love, all things become One and form a qualityless Ball (Sfayros), thus assuming that neither fire nor other elements preserve their identity in it [the Ball], and each of the elements loses its inherent form (eidos).

## **Control questions**

1. What are the ancient ideas about the functioning of the world?
2. What could be the reason for this understanding of the functioning of the world?
3. What are the modern concepts of physics on the processes described in the excerpts?

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