

L4) The Inorganic Research Method.

By Dr Robert Rose

As has been said previously, a teacher in a Steiner School is encouraged to be a researcher of their curriculum, practice and situation. This does not mean just how you teach and how children learn, but also the **content** of what is taught, i.e. the core of the curriculum. An example of this is that part of the curriculum that is to do with the inorganic sciences and its research methods.

The inorganic research method is particularly relevant to the curricula in the physical sciences, technology and mathematics. The former of these include physics and chemistry which begin as separate subjects usually in class 6. The concept of this field of research is encapsulated in an interchange between a teacher at the first Steiner/ Waldorf school and Rudolf Steiner:

*“A teacher: I am having trouble with the law of conservation of energy in thermodynamics. Dr. Steiner: Why are you having difficulties? You must endeavour to gradually bring these things into what Goethe called “archetypal phenomena.”... Such things are phenomena, not laws. You will find that you can keep such so-called laws entirely out of physics by transforming them into phenomena and grouping them as **primary and secondary phenomena**.”*
(Faculty Meetings with Rudolf Steiner, p. 28/9).

So what did Steiner mean by “archetypal phenomena” and “primary and secondary phenomena”? This is a reference to his early work “A Theory of Knowledge...”, in particular chapter XV. As in all of his indications concerning all knowledge, including the natural sciences, Steiner recommended the use of the **“phenomenological approach”** which leads to the discovery of **phenomenological laws**. This approach tries to avoid the use of metaphysical theory too soon, especially in the early years of the education. Metaphysical laws would be more likely to be taught in the upper school as an introduction into modern physics and science generally. Especially when it comes to teaching, Steiner wanted teachers to develop this phenomenological approach in order that natural science remained within the sphere of experience that the children have direct access to and which is not beyond their personal perception. In this power point I want to explore what this means from a practical perspective. If you wish to explore the more philosophical aspects of this read the relevant chapter referred to above.

Let us see how Steiner described this type of nature and how the structure of inorganic science can be built up:

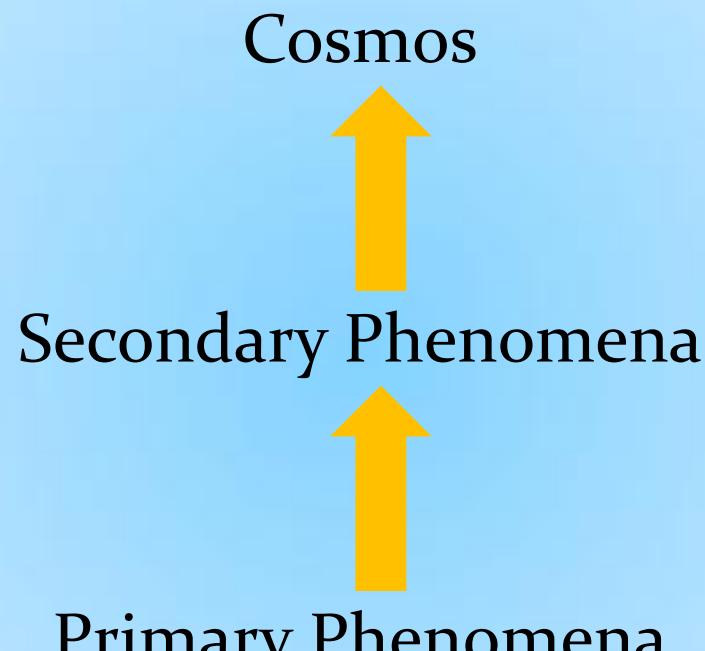
“THE SIMPLEST form of action in Nature seems to us to be that in which an occurrence results wholly from factors **external** to one another... The system of actions which happen in this fashion, so that one fact is always the result of others of similar sort, is called **inorganic Nature**... Here the course of an occurrence or the characteristic of a relationship depends upon **external determinants**; the facts bear marks in themselves which are the results of these determinants. ” Steiner, R (1886): *A Theory of Knowledge*... p 73.

“In this way the mind resolves all phenomena of the inorganic world into those in which the effect seems to the mind to come directly and of necessity from the causative factor. ” *Ibid*, p. 77.

“Now, a phenomenon in which the character of the occurrence can be seen in transparently clear fashion to result directly from the nature of the factors under consideration is called a **primal phenomenon**, or fundamental fact. This primal phenomenon is identical with **objective natural law**. For in it there is expressed the fact, not only that an occurrence happened under certain definite conditions, but that it had to happen. ” *Ibid*, p. 77/8.

“Scientific satisfaction will come to us from a point of view only when it leads us into a **totality** [a Wholeness] complete in itself. But the sense-world as inorganic does not appear at any point as brought to a conclusion; nowhere does an individual whole appear. Every occurrence points to another upon which it depends; this to a third; etc. Where is there any conclusion in this? The sense-world as inorganic does not arrive at individuality. **Only in its totality is it complete in itself.** We must strive, therefore, if we would have a whole, to conceive the assemblage of the inorganic as a system. Such a system is the **cosmos.** ” *Ibid*, p. 81 (My bold).

So, for Steiner, we can deduce that, there is a distinct structure to the levels of inorganic method and explanation:



[Originating from external determinants or factors]

So for Steiner, we can begin with simple primary phenomena, lead these over to secondary phenomena and then, **after many levels of research**, come eventually to the explanation of the cosmos. What we find in modern cosmology is an attempt to bring together the unity of all primary and secondary phenomena, but with the addition of the metaphysical laws of modern physics. But this is beyond the scope of what we are trying to do here.

Steiner then saw the inorganic realm as the simplest form of Nature. A phenomenon of inorganic nature, for him, came into being through a given set of conditions that were not a part of the phenomenon itself.

Lets begin with a simple example, a shadow is such a phenomenon. Contemplate the following picture and describe to yourself the relationship between light and shadow/shade:

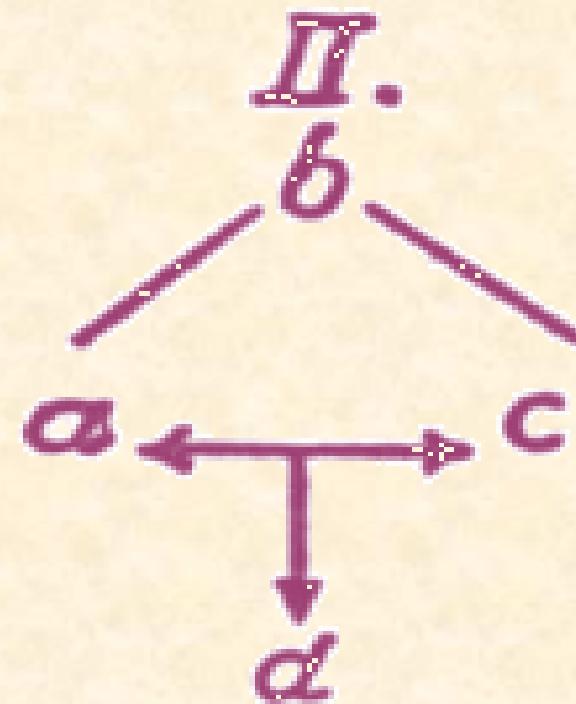
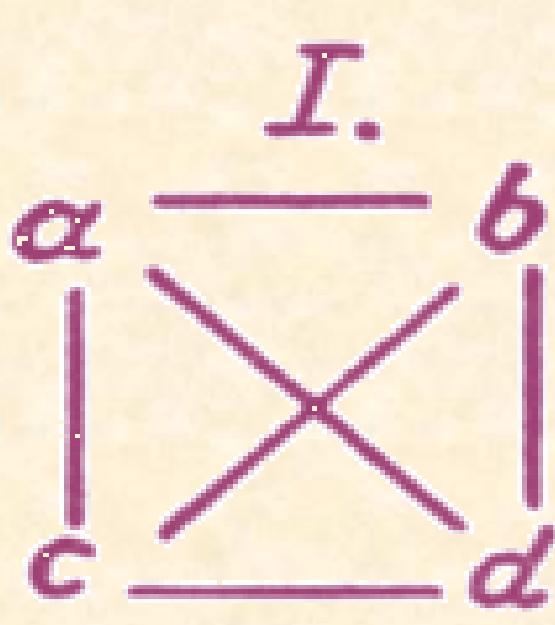


The shadow/shade is produced when a light source, such as the Sun, comes into relationship with an opaque object, such as a tree. The shadow has no existence of its own, its existence is entirely conditioned by the light source and the opaque object. In this scenario, the Sun and the tree play the role of the external determinants.

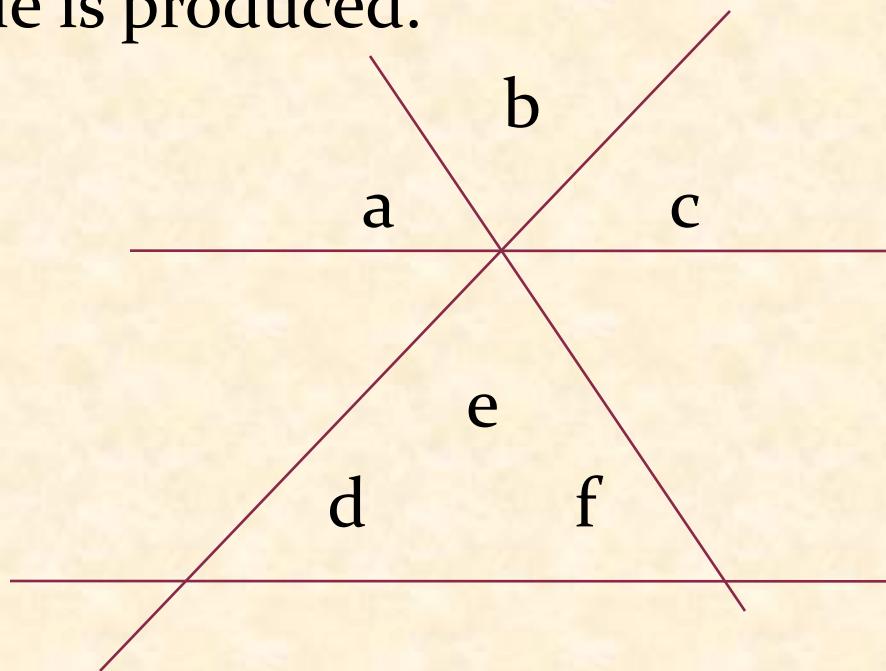
A researcher of the inorganic, such as a teacher in a Steiner school, would observe inorganic phenomena and try to find the essential conditions under which it comes into existence, which conditions were primary and which secondary. The first phenomenon that comes into being and which can subsequently bring the next set of phenomena into being, is called the “primary phenomenon”.

As you may know from personal observation, shadows are pale images or copies of the original object, a kind of replicated form. If you look at the picture in the bottom right hand corner, you will see the shadow copy of the outline of the bushes and rocks just above. This is one very simple example of a primal phenomenon which, when joined with others and some secondary phenomena and the appropriate conditions leads, eventually, to phenomena like those created by the pin-hole camera.

You will find the following methodological diagram in the original text which expresses the general set of *potential* relationships between the observable phenomena and as the starting point for discovering the primary and secondary phenomena and the conditions which produce them :

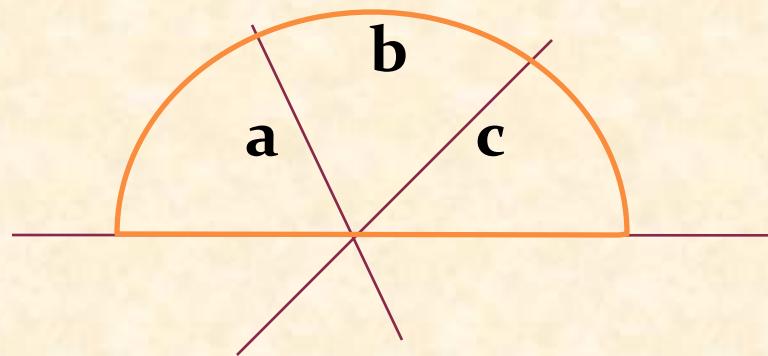


To elucidate this, consider another example drawn from mathematics. Draw the following lines such that a triangle is produced.



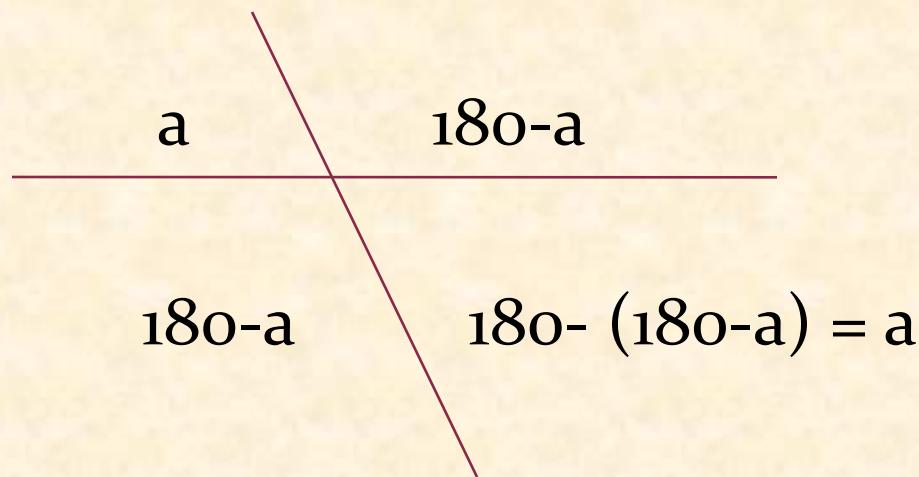
So how do we work out that $d+e+f = 180^\circ$?

In mathematics we may be used to the idea that the sum of the angles of a plane triangle is always 180° . Lets try to see why using Steiner's inorganic method. Take a line and bisect it with two other lines which converge on that line:



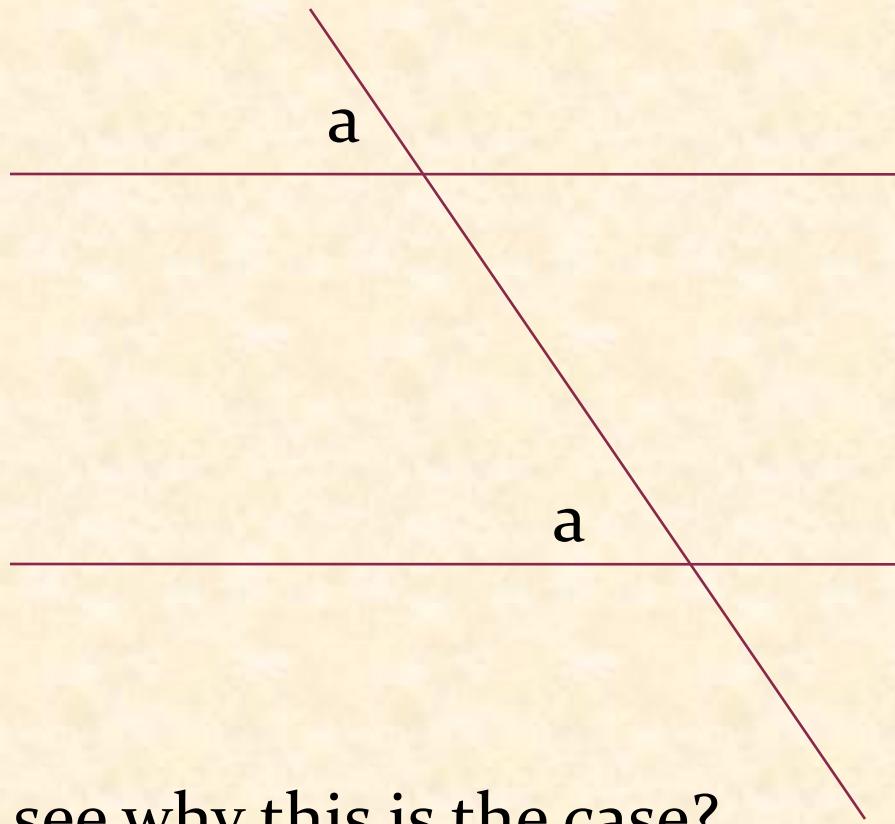
Let us assume now that the orange arc can be divided up into 180° . Clearly then the sum of $a+b+c = 180^\circ$.

Lets then simplify this to just two lines. See if you can work out why the following must be the case:



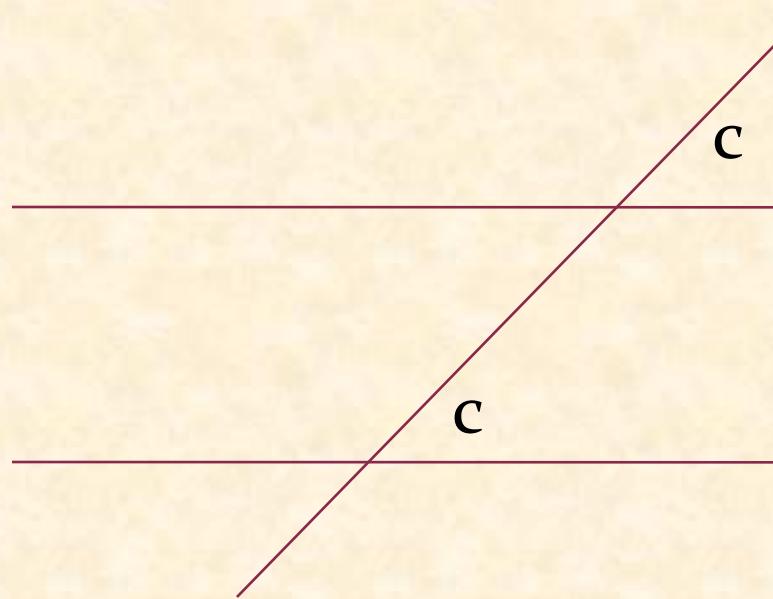
Which gives you the primal phenomenon: **vertically opposite angles are always equal**.

Now take another part of the original question and the angles on the second parallel line:



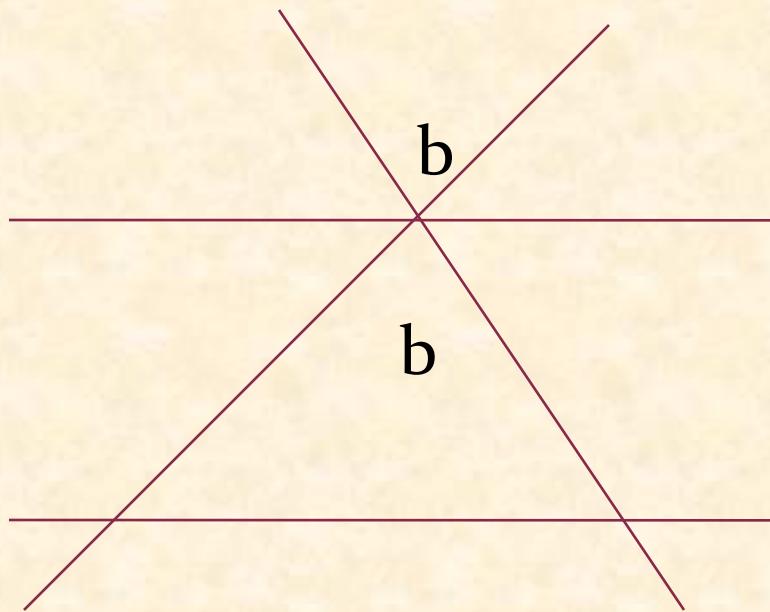
Can you see why this is the case?

And:

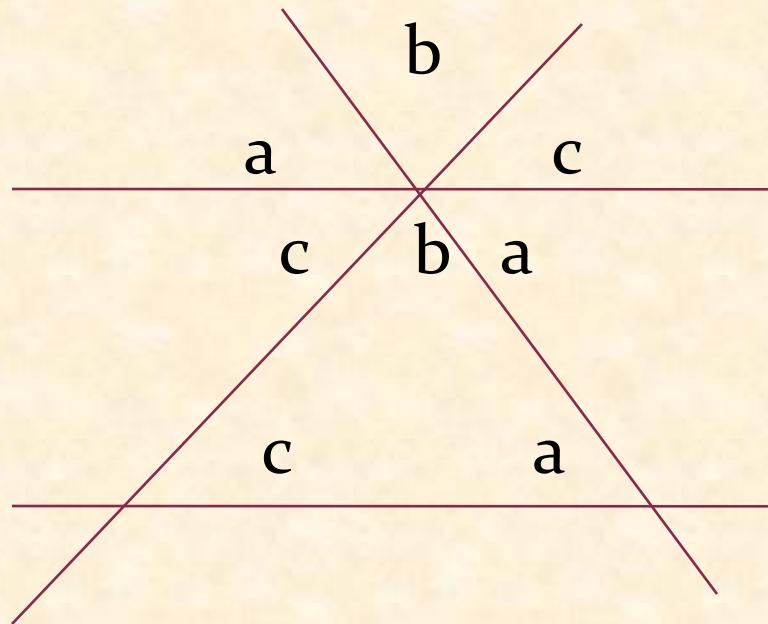


Both of these are examples of the idea:
Corresponding angles are equal.

Also:

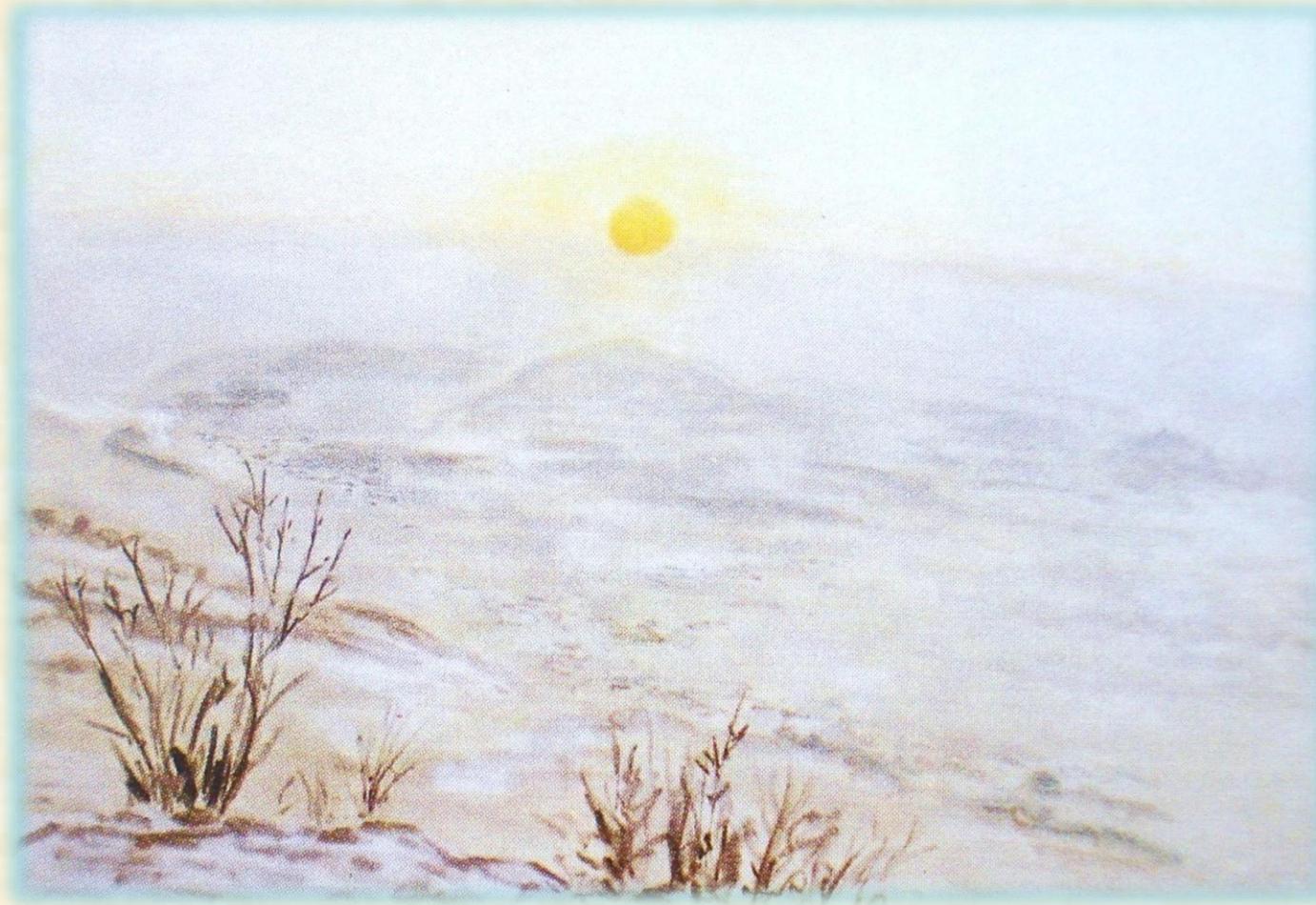


How does this apply to the original problem:



Hence $a + b + c = 180^\circ$. Try to think this through.

Consider some other examples of inorganic nature: see if you can find the primary and secondary phenomena.



Light in the landscape

The painting is an original done by an artist as the Sun rose above the Jura mountains in Switzerland.

Here we have the Sun rising majestically above the horizon. When observed in real life, the Sun begins as a deep orange/red and gradually becomes yellow, finally a brilliant white: why? Why does it not just stay yellow, or white? The reverse happens at sunset.

The first condition is that the atmosphere is semi-transparent, but it still has a kind of darkening effect on the Sun when it is near the horizon. This is partly due to the fact the atmosphere is denser there from the viewer's perspective. This leads to the primal phenomenon first formulated by Goethe as: **"Light that is increasingly darkened due a medium turns from yellow to orange to red"**.

The blue sky is in a sense the opposite to this, Goethe formulated this primal phenomenon as: **dark** (as in the dark of space in this instance) **seen through a light illuminated medium** (the atmosphere illuminated by Sun light here) **appears increasingly blue**. Modern physics sees this "Yellow to Blue" phenomenal pair as a case of the dispersion of light. There is not enough space here to go into detail of the similarities and differences of there two approaches.

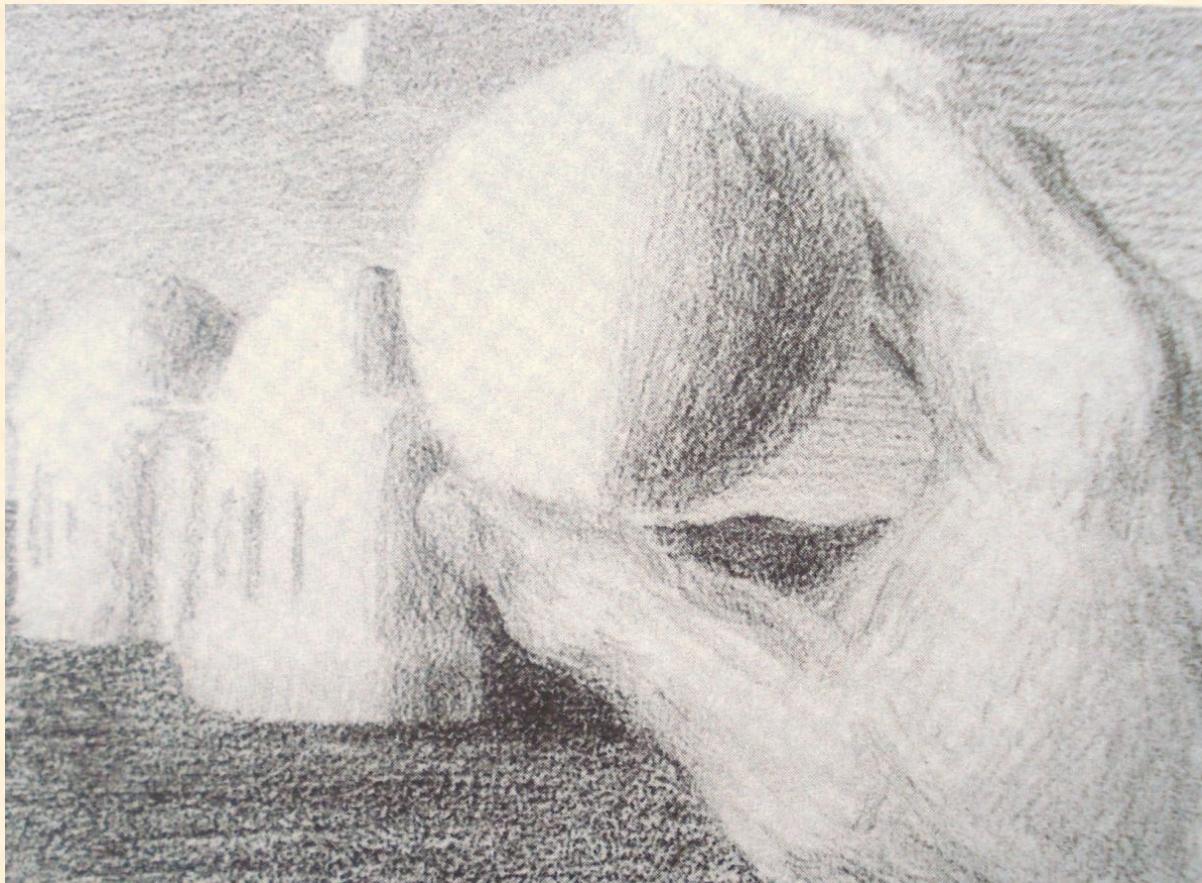
Anyone who has been in an aeroplane will have seen the opposite occurring in that as the plane ascends, the blue of the sky will become increasingly dark. This is also the reason, according to Goethe, that the sky looks a deeper blue in the mountains.

These are examples of **phenomenological laws** and are different at one level from **metaphysical laws** which refer to physical principles beyond direct sense-perception. This is a topic that would more likely be introduced in the upper school. There students would be introduced to current physical theories such as the wave – particle characteristics of light and an exploration may be made of the connection of these to the phenomenological laws and events.

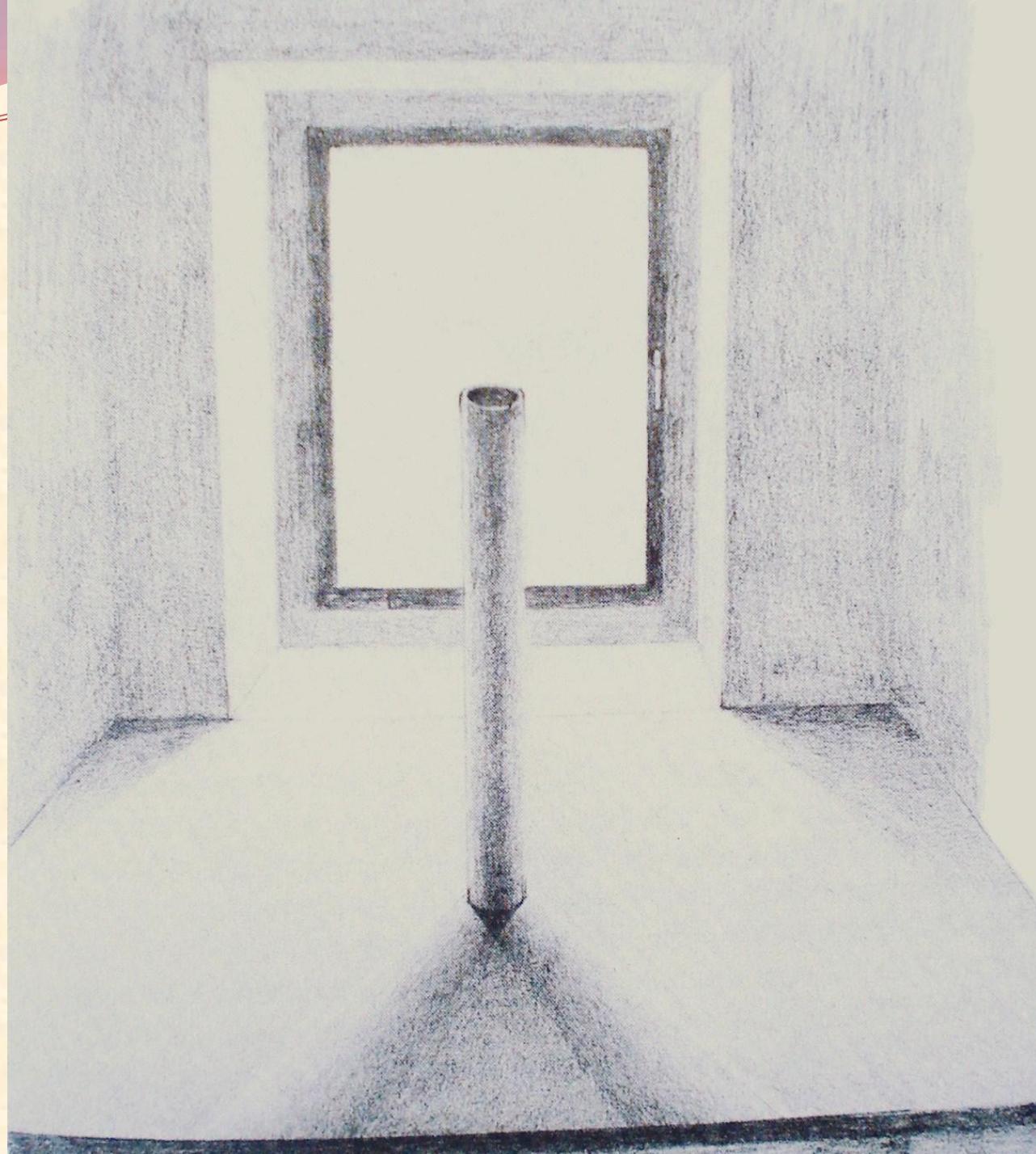
You might like to try doing the next few examples. Please remember to observe carefully, perhaps even replicate in real life what you observe and see if you can find the primary and secondary phenomena. Try to give a rich description of what you observe and attempt to see beyond the obvious.

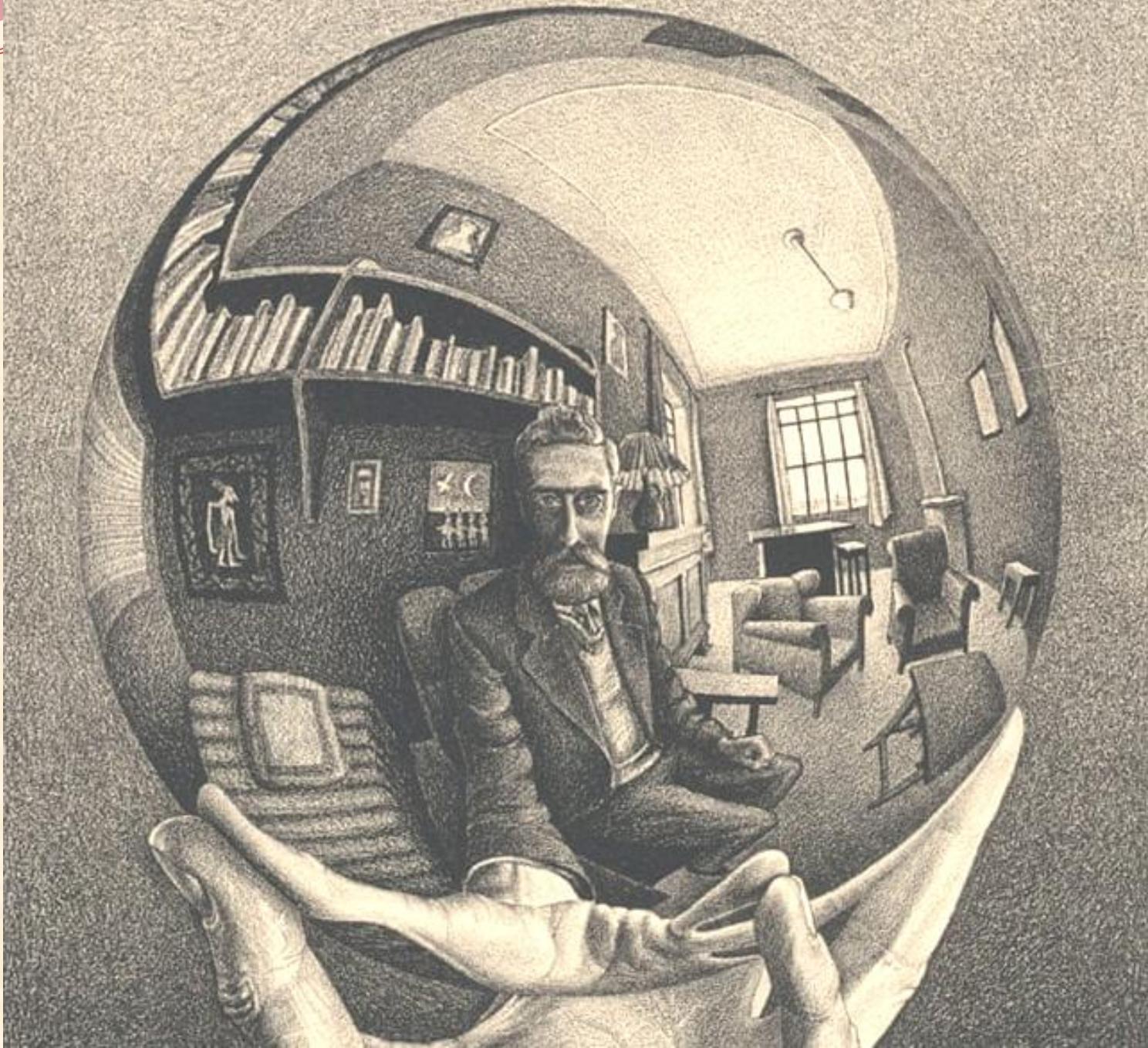


- Class 7/8
light and
shadow



Moon phases
and Earth
light





Exercise on the Curricula

You might like to read ahead here to look at what the curriculum is for the “inorganic sciences”. These essentially include physics, chemistry, mathematics and technology. This will be covered more in module 6, but if you wish to look ahead, then the book by Avison & Rawson (eds) (2014): *The Tasks and Content of the Steiner-Waldorf Curriculum*, Floris Press, would be a valuable resource. If you wish, you could make a simple list of the curricula for the inorganic sciences and the corresponding school year just to give yourself a sense for what is taught and when.