

## 48 Science in the Senet Board

The Senet Board has a very ancient history. We do not know how far back it goes, but its glyph appears in the name for the first pharaoh of the first dynasty, the man who unified South and North Egypt into a single country, -- and it goes back well before that time. The same glyph also appears in the name of one of the primordial gods, the Hidden God, Amen.

The early round game boards known as Mehen never had a standard number of "scales" on the coiled serpent, but all examples of Senet Boards from the earliest times have precisely the same 30 squares arranged in a rectangular form of three rows of 10 Houses each. There must be a reason why this was so, because what we know about the game does not require there to be a fixed number of squares on the board. In fact, the Backgammon form of the game later changed the design of the board and increased the number of pawns and playing positions.

While reading around among the ancient Egyptian literary stories that have survived I encountered a strange tale in the Westcar papyrus, a text said to have come from the middle period of Egyptian history. However, the story is set in the time of Khufu, the pharaoh of the Old Kingdom 4<sup>th</sup> dynasty who is said to have built the Great Pyramid of Giza. In the story prince Hordadef knows that his father wants the geometry of the pyramid to be very precise and contain important mathematics of the universe. He hears of a very old man named Dedi who is supposed to know this knowledge and tells his father about the person. Khufu asks Hordadef to go find this man and bring him to share the information with pharaoh. Hordadef eventually finds the old man, but the old man says he does not know the information, he only knows where it is. He says it is in a stone box belonging to Thoth in a chamber of the Sun Temple in Heliopolis. He says that this box contains the numbers of the cosmos, but that Hordadef may not go get the box, because it will be brought later by a king who will live in the next dynasty. Then the story cuts off and we never find out what the numbers are or how they could possibly be encoded into the Great Pyramid after it was built.

We have found copies of a New Kingdom text that I call the Great Game Text. This work describes the layout of the Senet Game Board. There are even badly damaged drawings of what it looked like fully decorated. (Many boards have no glyphs or only have a few squares marked.) Apparently people knew the game board by heart and also may have used various layouts of the glyphs, so they often just drew the squares. There are even hints in the Game Text at the possibility of one or more types of oracle boards. No set of rules survives from ancient times, but we know that the Egyptians sometimes made boards in the form of a box with a drawer for the pawns and the throwing sticks.

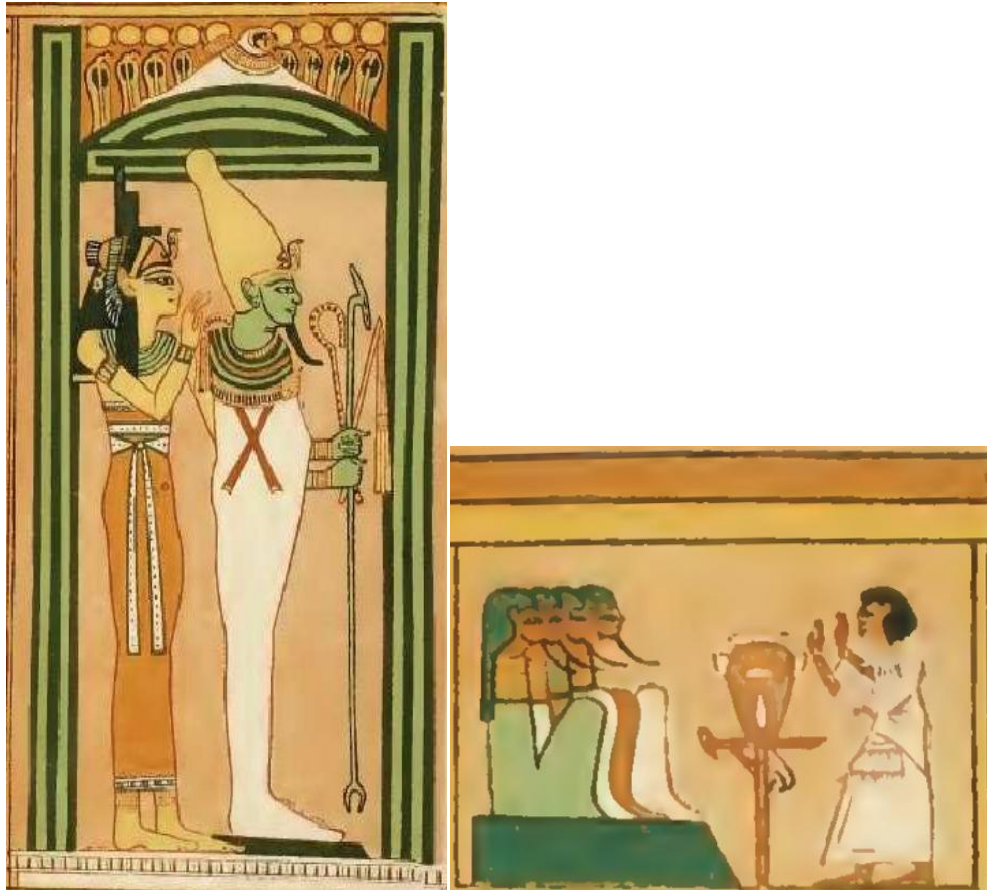
We know that Osiris definitely has a place on the board. In the art of Osiris in his role as judge in the Weighing of the Heart ceremony Osiris commonly stands on a curious slab of stone that is like a long rectangle, but with a slanted edge at one end. Scholars do not know what it represents, but the word for it is Maat, the name of the Goddess of Truth, balance and fairness. The glyph also has a sense of straight and stable. Some think it was a kind of chisel, and others suggested it is a stone from the outer casing of the Pyramid. However, tests of such stones reveal that it is not the right shape. I wondered for years why the little stone platform has the funny angle at the front until one day it struck me that this stone could be a Senet Board with a slice removed to give out a special piece of information.

So I started studying the geometry of the board. There is no standard scale for the board, since it is found in a variety of sizes. Only the geometry is always exact with the 30 squares. After I had organized a Senet Oracle Board design based on the Weighing of the Heart and the Solar Boat tableaus, a couple of hypothetical questions arose in my mind regarding the Maat slab. What if the slab really represented the Senet Board? And then an even wilder question arose: What if the strange slanted line on the slab was the key to unlocking Thoth's numbers of the universe?

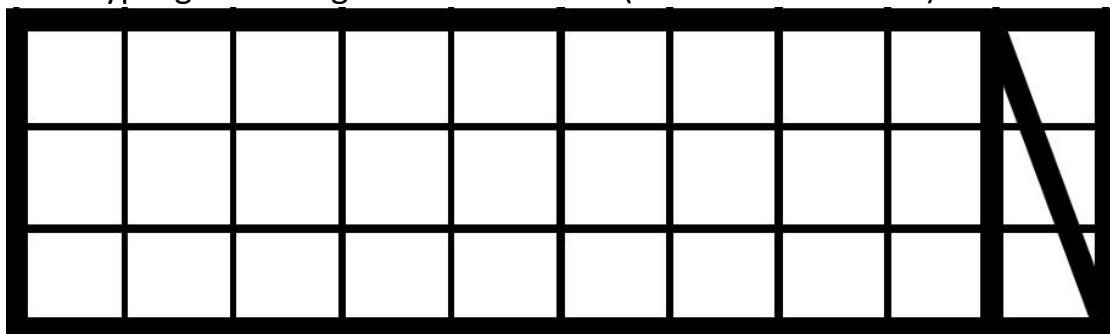
In my design for the Oracle Board the Magician stood on the Maat slab just above Maat, the Goddess of Truth, and right behind her stood Thoth. The diagonal line on the slab could not work for the Game Board layout, but it appeared to slant from the tip of the Tower down to the tip of the tail ornament that hung in the corner where Thoth stood. Maybe there was something special about this diagonal.

The top row consists of an Ennead (Group of Nine) archetypes with Ra at the head as their Chairman in the tenth position. Perhaps the Oracle Board has two components: the 3 squares on the far right plus the three rows of 9 squares that filled the rest of the board on the left. The Magician and the Tower form a border between the 3 squares on the right and the rest of the board. Lady Justice anchors the Magician.

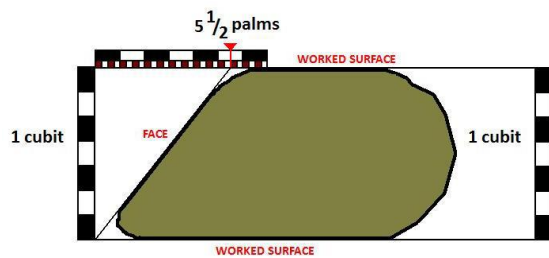
I noticed that the 3 squares have the same shape as the 27 squares, but at a smaller scale. What if this was a deliberate structural feature? The ratios would be the same for each rectangle, just three times larger (or smaller). If the rectangle on the left had squares of  $1/3$  on a side, the length of its whole rectangle would be 3 and its height would be 1. It would have a diagonal 3 times as long as the diagonal at the end of the slab. According to the theorem of Pythagoras, a 1-by-3 rectangle has a diagonal of  $\sqrt{10}$  or approximately 3.162. I had seen this number before in writings on quantum physics. Two physical constants are commonly found multiplied together in quantum theory: the velocity of light [ $c$ ] and Planck's constant [ $\hbar$ ]. The former has the value of  $3 \times 10^8$  m/s, and the latter has the value of  $1.054 \times 10^{-34}$  kg m<sup>2</sup>/s. The product is  $3.162 \times 10^{-26}$  kg m<sup>3</sup>/s<sup>2</sup>. Scientists frequently just give these two physical constants the value of 1 in their equations and ignore them with that shorthand. A long diagonal stretches from the tip of the Tower to the heel of Ani's Lover. The short diagonal from the tip of the Tower to the corner where Thoth stands then has the value of Planck's reduced constant and also is the radius of a circle around the Tower that has a circumference of Planck's non-reduced constant [with a "number" of approximately  $2\pi \times 1.054 \approx 6.626$ ]. Disregarding scale for a moment, these numbers are at the foundation of modern physics and could quite well be considered Thoth's numbers of the universe. Moreover, the geometry is simple and independent of scale. If the diagonal of a single square (with unit side) is  $\sqrt{2}$ , and the diagonal of a rectangle made of two squares is  $\sqrt{5}$ , and the diagonal of a rectangle made of three squares in a row is  $\sqrt{10}$ , then we also have the mathematics of the Golden Ratio hidden in the Senet Oracle Board.



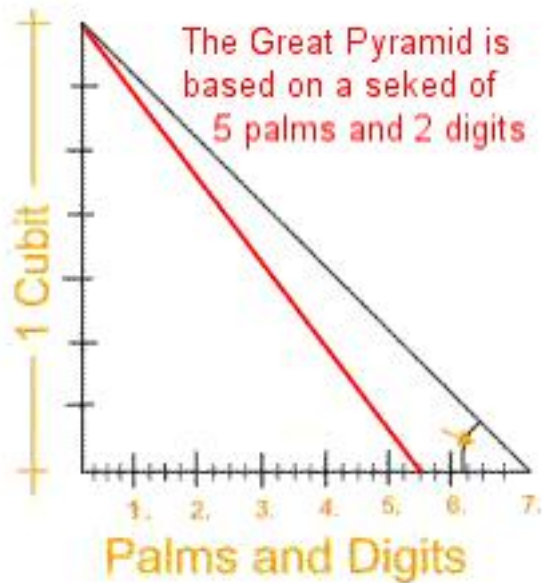
Left: Isis stands behind Osiris in his mummy form while Osiris stands on the Maat slab. Right: Ani honors his divine heart in front of a row of archetypal gods sitting on the Maat slab (Senet Oracle Board).



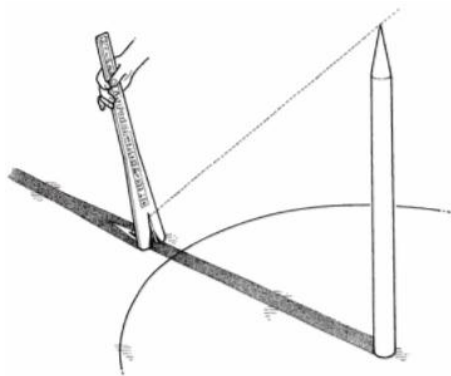
The Senet Oracle Board is shown above with the diagonal slicing across the right hand column of squares, from the Tower to Thoth.



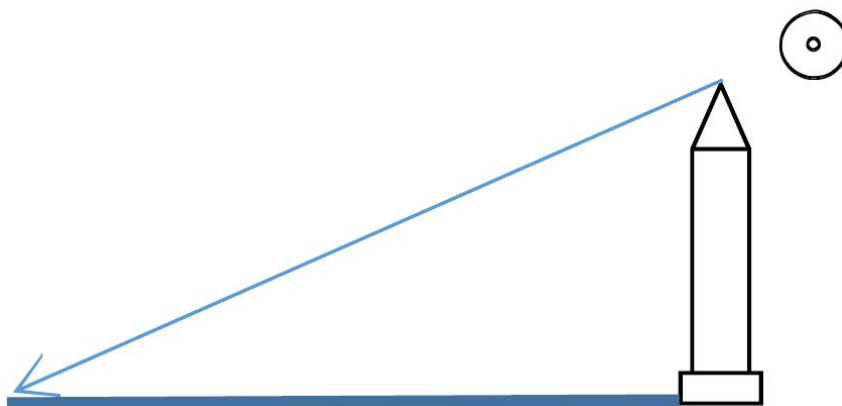
Outline drawing of a stone from the Pyramid's outer casing layer.



The traditional Egyptian calculation of the angle of the Great Pyramid.



An obelisk could be used as a gnomon for measuring the sun's shadow. The other stick (called a bay) held in place by a man's hand is used for greater precision of measurement.



Shadow cast by Ra from the Tower Obelisk down to the Lower square.

In order to decode the Universal Numbers on the Senet Oracle Board we need to first understand how the ancient Egyptians knew about the meter and the second, units that we think are modern inventions. Actually these units have been known for thousands of years and there is plenty of evidence in Egyptian classical art. The second as a unit of time is simply the pulse of the heartbeat in a very rested state. The Egyptian concern for the importance of the heart and Egypt's medical knowledge of human anatomy and physiology led them to have a lot of attention on the role of the heart in human life.

The meter is simply the half period of a pendulum with a string of one meter length. The Egyptians from very early times used plumb bob pendulums to determine an accurate vertical line in construction of buildings.

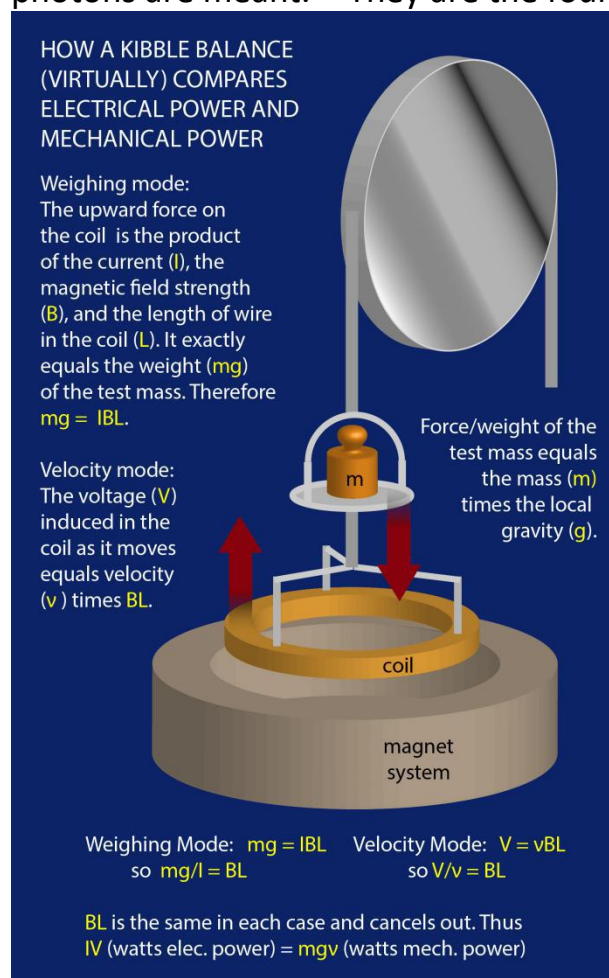


Egyptian pendulum plumb bob.

The Egyptians used this tool frequently and also could use it for keeping time in rhythmic gymnastics and musical training, two areas that we know were very popular and well developed. They certainly noticed that a pendulum keeps accurate time, and the pulse depends on the length of the pendulum string. So the meter-second relationship is very ancient knowledge and was the original proposal in the 17<sup>th</sup> century for modern units of space and time by the English scientists, architect Christopher Wren and polymath John Wilkins. Both these men were founding members of the British Royal Society elite group of scientists. It was later "over-ruled" by a French group that wanted to use the size of the Earth as its basis (but made errors in its original calculations.) The pendulum proposal was rejected, because it suffered from slight discrepancies in the shape of the Earth such as massive mountains and equatorial bulge. (Of course, the French proposal had the same accuracy problem.) Currently the constant velocity of light in free space is used as the measure for the meter, but the choice of units goes back to the

ancient pendulum knowledge. The second is now based on the vibration of a cesium 133 crystal, which is not very satisfactory in my opinion. I do not have any cesium lying around my apartment. Do you? The Bathys Hawaii Cesium 133 watch is now available.

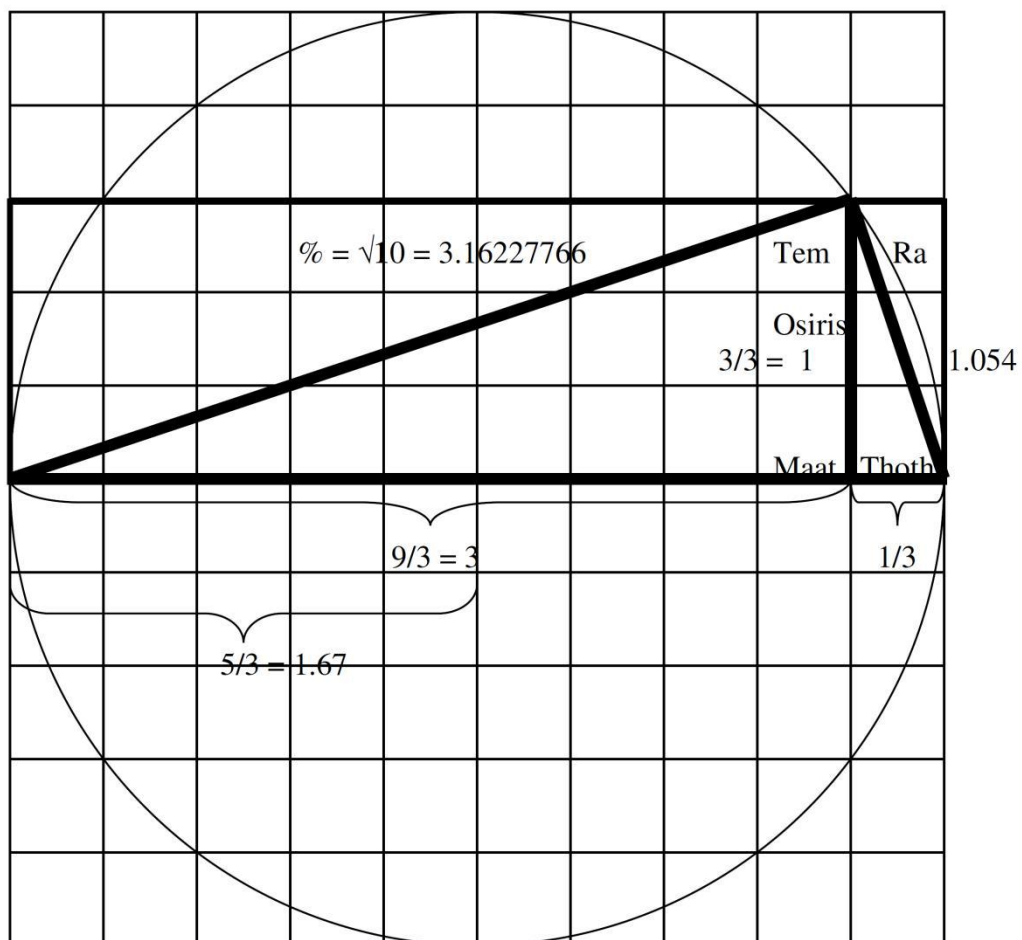
The third major unit of metrology is the kilogram. Originally this was defined as the mass of a liter of water (a cubic decimeter), which in turn was based on the meter unit. Later they built a prototype kilogram of metal, because it was difficult to accurately measure a liter of water. However, that metal prototype keeps changing slightly over time, so it is being abandoned this year (2019) in favor of basing the kilogram on constants of nature. As a result the velocity of light (a meter being defined as the distance light travels in a vacuum in  $1/299,792,458$  of a second) and Planck's constant (set at  $6.62607015 \times 10^{-34} \text{m}^2 \text{kg/s}$ ) will be defined as constants based on many measurements made in various ways. "The Planck constant relates a light particle's energy, and hence mass, to its frequency." (**Wikipedia**, "Kilogram") By "light particle" photons are meant. They are the foundation of all phenomena.



Credit: NIST

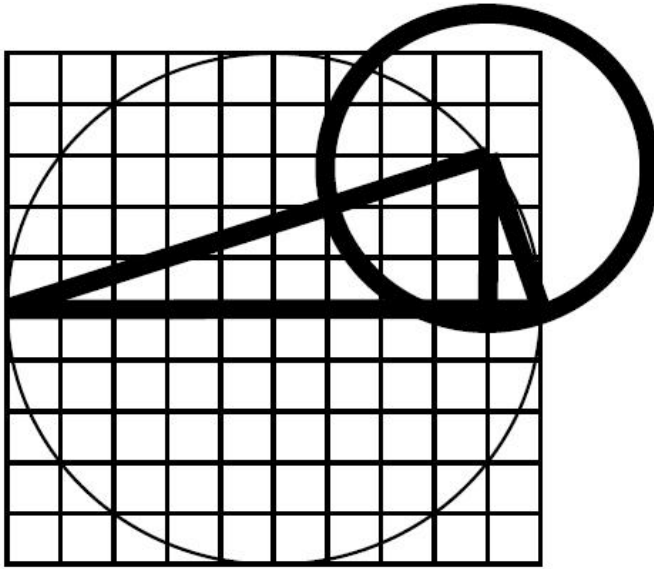
The new kilogram standard is possible because an instrument called the Kibble balance has finally been developed to measure mass reliably in terms of these universal constants. It does so by balancing electrical and mechanical power.

The Senet Oracle Board system of “numbers” is based on the sacred geometry that is built into its design. The “numbers” in relation to physics are just approximate guidelines that reveal the relationship of abstract geometry to the actual physical phenomena of the universe.



Here is a Senet Oracle Board inscribed in a circle inscribed in a square and also showing the large and small diagonal lines. Some of the universal “numbers” are marked.





The small diagonal is the reduced Planck constant “number” and the thick circle shows the non-reduced Planck constant “number”. The large diagonal is three times longer than the smaller diagonal. Two of its units (the diameter of the circle around the tip of the Tower) give the Natron Line (Sodium Line) energy of 2.108 eV, which is the brightest component of visible sunlight (ranging from  $5.88 \times 10^{-7}$  m to  $5.89 \times 10^{-7}$  m wavelength). They did not use 1 eV, because that light is not visible to the human eye. Natron was a sacred substance in ancient Egypt. There is a special relation of this Natron (sodium) “number” to Planck’s constant and the velocity of light, as the larger diagram shows. (For more details, see my book **The Cosmic Game**).

The velocity of light is encoded in the middle row on the left side. The length is  $9/3 = 3$ . The scale of  $10^8$  meters per second is given by the 8 squares that lead from the left to the Lord of Vision. The Magician square represents the “absorber” and is part of the “number” but not part of the distance traveled per unit of time ( $10^8$  m/s).

The 27 squares on the left side of the Oracle Board represent the two basic nucleons (proton and neutron), which are the massive components of all stable physical particles, roughly  $5/3$  of which (the protons) have electrical charge. The nucleon “number” is 1.67 (or  $5/3$ ). The 27 squares on the left side of the Oracle Board represent the scale of the mass:  $10^{-27}$  kg.

Including the additional 3 squares on the right side gives us the scale of the electron: ( $10^{-30}$  kg) and corresponds to the electron. The actual

current measurement is  $9.11 \times 10^{-31}$  kg, but this rounds off to  $10^{-30}$  kg. The negative scale takes us to the square of Thoth, who governs communication. All communication occurs via photon interactions with electrons. For positive scales we end on the upper row. For example, an average mass for a medium star in a system like ours is about  $10^{30}$  kg. Our sun is about twice that mass, but may slim down close to that mass by the end of its career.

“Gravity” is a **natural phenomenon** by which all things with **mass** or **energy** are brought toward (or *gravitate* toward) one another. (**Wikipedia**, “Gravity”.) That definition of course does not really explain why things “gravitate” toward one another. We can understand that it derives from the original unity of the universe. Diversity occurs because of resistance to unity. For a simple reason (boredom) unity begins to resist its own unity and blows apart into diversity. But the natural tendency to reunify persists as the primordial condition. So gravity is just the relaxation of resistance.

We locate gravity at the World Trump, and it is reflected below in the Wheel of Fortune that keeps things rotating and orbiting in the conflict of inertial momentum due to resistance and the relaxation due to a return toward the original condition of unity. This occurs at the 6<sup>th</sup> square from the left, which is  $2/3$  (6.67) of the way across the left-side rectangle. So the “number” for the gravity constant is 6.67. The current approximate value is  $6.674 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$ . I am not sure how the scale of  $10^{-11}$  is derived in the Oracle Board.

The “number” for Planck’s constant [ $\hbar$ ] is 1.054 and occurs in the small diagonal on the right side. The scale is  $10^{-34}$ . My suspicion is that the extra 4 orders of magnitude needed for Planck’s constant derive somehow from the 4 Kings, but I really do not know. However, the “number” 1.054 is right there on the board. The product  $\hbar c$  is  $3.162 \times 10^{-26} \text{ kg m}^3 \text{ s}^{-2}$ . This important quantum mechanics “number” occurs in the long diagonal on the left side. The scale seems to be in the 27 squares minus the Magician absorber, but I am not sure.

This information is very curious and appears to be fixed in the eternal geometry of the Oracle Board. All of this is a tentative hypothesis based on the remarkable coincidence of these well-known “universal

constant numbers” from physics showing up on what was thought to be originally just a Game Board invented for amusement.

One issue is that the meter-second pendulum principle known to the ancients is only relevant to the gravitational environment of Earth and is not truly a universal constant. I believe that the meter can be derived from the truly universal constant mass of the proton, and the second then falls out of the velocity of light. It may have been possible for the ancients to measure the velocity of light using simple technology like that of Fizeau, who made some of the first such measurements using a rapidly spinning toothed wheel. On the other hand, far ancient civilizations that are lost to us now may well have had accuracy far beyond ours in their measurements. In any case the natural evolution of metrology leads to the discovery of universal constants and their use as the the fundamental units of measurement. This has already happened in our recent evolution of science and will continue to evolve with further refinements as our knowledge and technical skill improves. Many issues still remain to be dealt with, not the least of which is a proper integration of mechanical units and electromagnetic units. Also the mathematics used would benefit from a greater recognition of a unitary system with reciprocal relations rather than playing around with unreal notions such as treating 0 as a number and infinity as a reality. The world has only defined and undefined conditions, and quantum mechanics has demonstrated that objects exist both locally (as particles) and non-locally (as waves) depending on an observer’s point of view.

For now all we can say is that we have here a curious speculation of “What if . . . ?” about Thoth’s stone box of universal “numbers”. Here is another “What . . . .?”

What if . . .

$$m_p = \pi e b / c.$$

Where  $m_p$  is the mass of a neutron ( $1.674929 \times 10^{-27}$  kilograms),  $\pi$  is the constant relation 3.14159....,  $e$  is the elementary charge constant ( $1.6021766208(98) \times 10^{-19}$  C, assuming the coulomb has a mechanical unit of kg/s),  $c$  is the velocity of light in m/s, and  $b$  is a magnetic constant that equals 1 meter. Then perhaps a constant standard “meter” that somehow can be measured hides inside each neutron. We await a resolution of the unclear relation of electromagnetic units and physical units and some experiments.

## 48 Study Questions

- \* Study the story of the stone box with the numbers of Thoth.
- \* Study the diagrams of the numbers that appear in the geometry of the Senet Oracle Board and their relation to fundamental constants in physics.
- \* Tie a weight to a string that is 1 meter in length. Hold the free end of the string and let the weight move back and forth like a pendulum. Time the interval of half a cycle. It should be very close to a second.
- \* Read on **Wikipedia** or scientific reports on the new kilogram standard that begins from May 20, 2019. Study the diagram that explains how the Kibble balance works.
- \* Why is the Natron line of 2.108 eV an important component of the numbers on Thoth's Oracle Board?
- \* What if it turns out we can derive the meter from a any neutron (or proton) and then take the second from the speed of light, both of which are very available rather than rare cesium 133?