PORTILLO

Midterm - INTD290

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1 Maps of The New World

(a) Virreinato 1 (b) Virreinato 2 (c) Virreinato 3 (d) Virreinato 4

Figure 1: There were up to four *virreinatos* during the Spanish colonial period of Latin American history.

1. In which of the four *virreinatos* of the Spanish colonial empire (shown in Fig. 1) was the ***tle huitzilin*** classified by the indigenous?
   (b) Virreinato 2

2. Which of the four *virreinatos* excelled at the exportation of rum?
   (b) Virreinato 2

3. Which of the four *virreinatos* was characterized by an indigenous empire that mastered agriculture in the Andean mountains?
   (a) Virreinato 1

4. The low-latitude aurora of 1789 was observed in *which cities?* In which of the four virreinatos are these cities? List some other countries in which corresponding observations were made.
   (b) Virreinato 2 (was observed in Mexico City) ***Some other countries where the aurora was observed were, Russia, Spain, Germany, the United States, Cuba, and England.***

5. List some of the locations explored by La Condamine and his Latin American colleagues, and cite the virreinato or virreinatos they explored together.
   (c) Virreinato 3, ***they explored what is now Quito, Ecuador.***

6. The Expedicion Botanica of Jose Celestino Mutis took place in which virreinato?
   (c) Virreinato 3

7. Jose Celestino Mutis took place in which virreinato? Mutis was the inaugural chair of the department of mathematics at the *Colegio del Rosario*. In which city is this?
   (c) Virreinato 3 ***Colegio del Rosario was located in Santa Fe de Bogotá, Colombia.***

8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been in the 18th century?
   (d) Virreinato 4, ***located in Argentina***

Figure 2: (Left) A physics detector near Pico de Orizaba in Mexico. (Right) A town in central Mexico.

Figure 3: A historical location in Latin America known for driving a particular economic sector.

2 Asynchronous Activity Review I

1. What is the physics detector shown in Fig. 2 (left)? Explain in basic terms the purpose of this detector and how it works.

The physics detector shown in figure 2 are the water tanks at HAWC, this observatory allows scientists to observe the charged particles that pass through it to emit light. The particles are traveling at the speed of light but due to the water in the water tank, they travel slower, thus allowing light to be given off. This is referred to as Cherenkov run off. The gamma rays go through the water as charged particles and the detectors pick up light and a flash a light appears in the water tanks. HAWC has many of these tanks set up in a pattern & this is so scientists can see where/what direction the particles are coming from and the amount..

2. What is the significance of Mexican cities as pictured in Fig. 2 (right), in the context of the development of colleges and the scientific community in 18th century Mexico?

Real de Catorce was once a thriving silver mining settlement and has long been a pilgrimage site for both local Catholics and Huichol shamanists. This is significant because during 18th century Mexico, these were all topics of discussion within the colleges and scientific communities. How people mined and created treatments for ailments would be revolutionized by the concepts proposed during the scientific revolution and the herbs of the indigenous people in Mexico. With the development of the colleges and communities, the people of Mexico were able to be educated. During this time period, knowledge is equated with power and learning allowed them to "progress" as a society and "catch up" to the Eurocentric viewpoints of the world.

3. What city is being shown in Fig. 3? In which country is it located, and what was the historical significance of this city for international trade? Who controlled it? From where the commodity produced here originates, and how was it shipped to Europe and Africa?

The city of Potosi, located in Bolivia, is displayed in Fig. 3. The historical significance of this city,in regards to international trade, is that it is responsible for over half of the world's silver supply during this time period. The struggle of power regarding who controlled it was between the Spanish virreinato in Peru and the indigenous people of the land. But needless to say the Spanish were the ones that truly controlled it. The mines had been run by the ingidengous and silver was obtained by going into the mine and taking the silver deposits out of the rock. It wasn't until the scientific revolution, that engineers were being trained to come up with better ways to excavate the silver in a more efficient way, and the engineers were also trained to mold the metal to various things including currency for the Europeans. There was also an increased rate of production from mines in present-day Peru during the late 1770s. This was caused by an increased demand for silver in Peru after the Audiencia of Charcos where Potosi and Oruro were reassigned to the new Viceroyalty of the Rio de la Plata in 1776. Due to this, silver would now flow through Buenos Aires, which made it easier to ship the silver to Europe and Africa.

3 Asynchronous Activity Review II

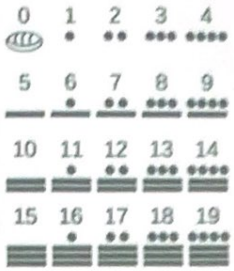
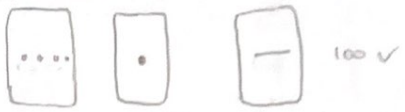


Figure 4: A list of the numerical digits used by the Maya.

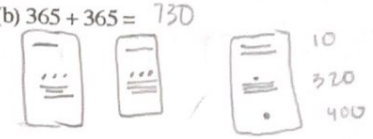
1. Work out the following addition problems *using the Mayan system.*

(a) 80 + 20 = 100



80 = 20 =
4×20¹ = 80 1×20¹ = 20
100

(b) 365 + 365 = 730



365 =
13×20¹ = 360 } 365 ✓
5×20⁰ = 5

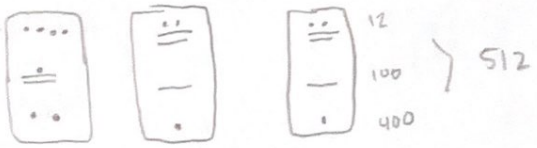
(c) 1024 + 512 = 1536

1024
2×20² = 800
11×20¹ = 220
4×20⁰ = 4
1024

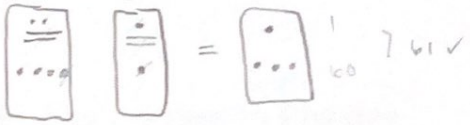
512
1×20² = 400
5×20¹ = 100
12×20⁰ = 12
512

2. Work out the following subtraction problems *using the Mayan system.*

(a) 1024 − 512 = 512

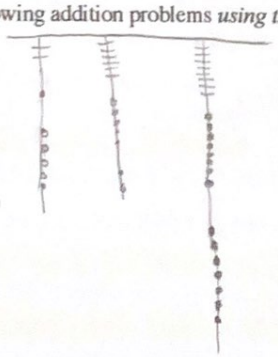


(b) 92 − 31 = 61



3. Work out the following addition problems *using the Incan quipu:*

(a) 512 + 256 =



(b) 11 + 89 =

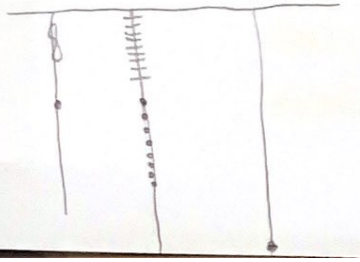
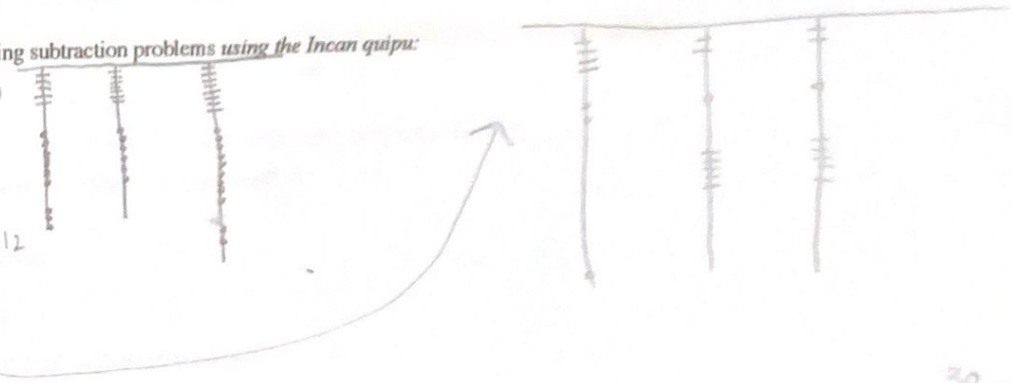


Figure 5: A physics detector near Malargue, Argentina.

4. Work out the following subtraction problems *using the Incan quipu:*

(a) 365 − 67 = 298

(b) 1024 − 512 = 512



5. Suppose you have six terrace plots in the Andean mountains to use to survive. You and your cohort of fellow Incans decide to grow potatoes and quinoa. Quinoa actually do better at higher altitudes that potatoes. So the plan is to use the two lowest terraces for potatoes, and the upper four for quinoa. Each terrace is 30 meters by 5 meters. A potato plant requires a 0.2 meter by 0.2 meter patch, and a quinoa plant requires a 0.3 meter by 0.3 meter patch. How many potato plants and how many quinoa plants can you plant? Store the results in a diagram of the quipu knot system.

A = 150 m² per terrace

$\frac{1}{5} \times \frac{1}{5} = \frac{1}{25}$ m²

$\frac{150}{\frac{1}{25}}$ m² / pot

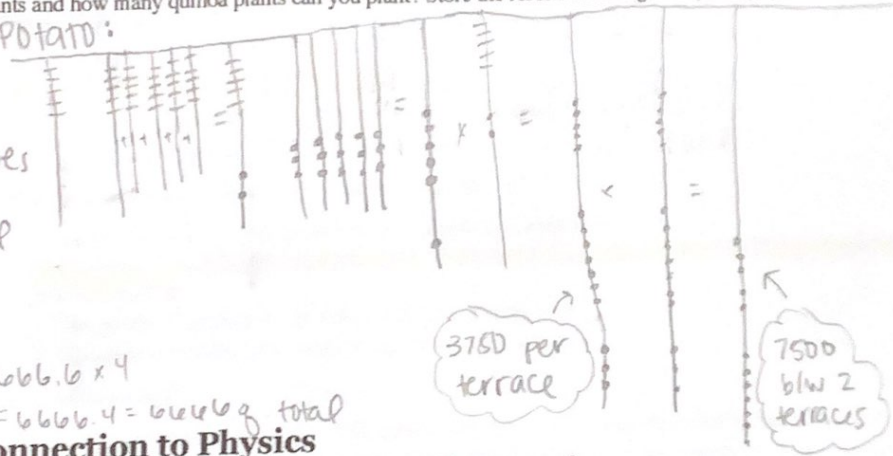
= 3750 potatoes × 2

7500 total

$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$

$\frac{150}{\frac{9}{100}}$ m² = 1666.6 × 4

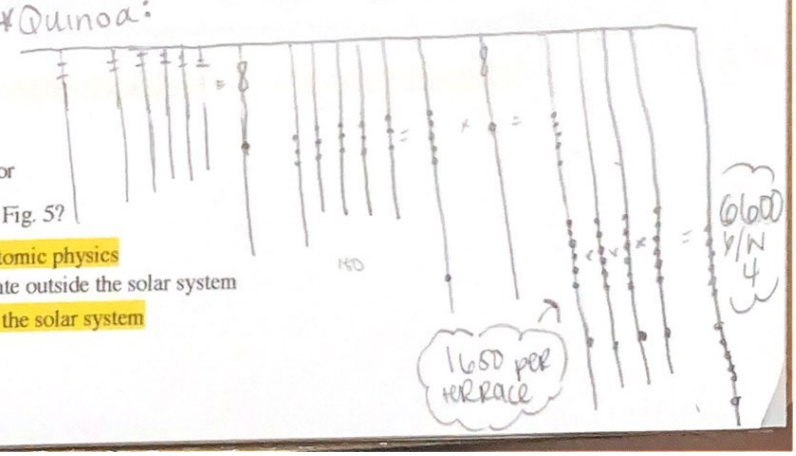
= 6666.4 = 6666 total



4 Connection to Physics

1. In Fig. 5, what physics detector is shown?
   - A: The Large Hadron Collider
   - B: The IceCube Neutrino detector
   - C: The Pierre Auger Observatory
   - D: The High Altitude Water Cherenkov detector

2. What is the purpose of the physics project shown in Fig. 5?
   - A: To collide protons and nuclei to probe subatomic physics
   - B: To detect signals from neutrinos that originate outside the solar system
   - C: To detect cosmic rays that originate outside the solar system
   - D: To detect gamma rays from space



3. What is a gamma ray?

- A: A photon of light
- B: A proton or nucleus from deep space
- C: A portion of the aurora borealis
- D: An ion floating in the atmosphere

4. What is located at each black dot in Fig. 5?

- A: A water tank designed to record Cherenkov radiation
- B: A radio receiver designed to record radio pulses
- C: An optical sensor designed to record visible light
- D: A telescope designed to detect infrared radiation

5 Vocabulary

1. What is the meaning of the term *rationalism*?

- A: The idea that reason rather than experience is the foundation of certainty in knowledge
- B: Encapsulating the idea of *I think, therefore I am.*
- C: Using scientific instruments
- D: Relying on measurements and sensory experience to discover the truth

2. What is the meaning of the *Nahuatl* term *abuizotl*?

- A: A horse
- B: A hummingbird
- C: An otter
- D: An alligator

3. What is the meaning of the *Nahuatl* term *tomatl*?

- A: Smoked fish
- B: Smoked chili
- C: An herb to help digestion
- D: A tomato

4. What is *cinchona*?

- A: An herb used to treat indigestion
- B: A shrub or tree used to create quinine
- C: A flower used in religious rituals of the *Mexica* people
- D: A plant that can form a treatment for syphilis

5. Define the word *torpor*, as it pertains to animal behavior.

- A: The ability hover in midair during flight using rapid wingbeats
- B: Lowering internal body temperature and metabolism to levels that render the individual immobile and in a hibernating state
- C: The ability to break open the shells of mollusks using tools
- D: The ability to distinguish complex sounds in songs or calls

6. Who were the *Jesuits*?

- A: Formally known as the Order of Preachers, this is a Catholic order founded by Saint Dominic
- B: Formally known as the Order of Friars Minor, this is a Catholic order founded by Saint Francis
- C: Formally known as *Los Amigos del Pa'ıs*, these were mining officials who formed guids to further economic interests of their region
- D: Formally known as the Society of Jesus, this is a Catholic order founded by Saint Ignatius of Loyola

6 Free Response Section

1. **Kepler's Laws, and Newtonian Physics** Discuss the varying levels of acceptance within scientific and academic communities in Nueva Granada and Peru in the late 18th century.

The most accepting group of the new foundations of sciences were the Jesuits; a Catholic order founded by Saint Ignatius of Loyal. In Quito, The Universidad Gregoriana and the Universidad Javeriana of Santa Fe de Bogotá were the first to promote the scientific spirit and taught Newtonian concepts. However, they did not always follow the laws of Newton and Copernicus, they made the transition from cartesian philosophy to Newtonian physics. The Domicans however, were a religious order that did not embrace Newtonian physics and still thought in scholastic terms meaning that they appreciated the teachings of the Bible, more or less, and thought that there was no reason to disagree with the text. The issue with this way of thinking is that it doesn't allow for empiricism to be implemented, meaning that data and observations are essentially irrelevant and experimenting was unnecessary . This was revolutionary for its time because by adopting this new mindset of empiricism, the people are abandoning centuries of knowledge, traditions and customs. The debate in Nueva Granada revolved around this shift in mindset and the idea that the planets obey Newtonian physics and did not follow what was being taught in the Bible. Newton's physics were further proved to be right by the extension of Kepler's Laws, one of the most revolutionary being that the sun was the focus of the ellipse in which a planet moves.

Some of the notable people within the scientific and academic communities that devoted some of their careers to proving the works of Newton and Copernicus were Jose Celestino Mutis and Charles de la Condamine. In March 1762, at the inauguration of the chair of mathematics at the Colegio del Rosario, Mutis expounded the principles of the Copernican system and of the experimental method of science, leading to a confrontation with the Church. In 1774 he had to defend the teaching of the principles of Copernicus, as well as natural philosophy and modern, Newtonian physics and mathematics, before the Inquisition. He presented his 16 thesis to them, proving the new teachings of Copernicus and Newton to be true. The geodetic expedition of Charles de la Condamine in 1735 also proved the Copernican and Newtonian theories regarding the shape of the earth to be true.

2. **The aurora of 1789** Discuss the significance of the aurora borealis in 1789 that was visible from Mexico City. List several researchers who made observations of this aurora and other auroras, and explain what they found.

Auroras happen when particles from the Sun interact with gases in our atmosphere, causing displays of different colored light in the sky. Auroras are often seen in areas near the North Pole or South Pole. There were 3 Mexican scientists that drew the conclusion that auroras were correlated with sun spots and this allowed them to make predictions of when the next ones would be and how they were able to be seen from different parts of the world. One of the scientists, Jose Antonio Alzate y Ramirez predicted the aurora would have been observed in other countries, including Spain, and as far away as Russia. Scientist Antonio de Leon y Gana drew conclusions that auroras would be observed differently due to the chemical/physical disparities of the Earth's atmosphere in different parts of the world, altitude, and phases of the moon. This being what dictates what colors are observed within the aurora. In efforts to explain what both Alzate y Ramirez and León y Gana had discovered, scientist Jose Francisco Dimas Rangel presented an experimental design to replicate effects of aurora to scientific communities of Mexico. This was significant because this was the first time that contemporary physics and the chemistry of the atmosphere was being applied to something. The auroras showcased what chemically and physically occurs when charged particles are sent through matter.

3. **Herbal medicine in the 16th century** Give several examples of treatments for various ailments in the body used by Europeans and indigenous Latin Americans in the 16th century. Explain the theory of the four humors and why this influenced the European treatments but not the indigenous ones.

During this time period, both Latin Americans and Europeans had their own way of treating ailments. One of the notable ways they varied in treatments was the way they treated/mended broken bones/ribs. Europeans mended broken ribs by creating a mixture of dry ground goat manure baked with wine and plastered it onto the person's ribs. While the Nahua people had established a practice of bone-setting that involved pushing a stretched zacacili poultice with a splint cut with obsidian knife, apply iztaczazalic and tememetatl to cut. Their whole process differed and the Europeans had no way of easing pain or swelling. They also treated diarrhea differently. Europeans treated dysentery by creating a mixture of manure with wine vinegar ground pig feet with wine dog urine with wine. Whereas the Nahul people utilized the herb tzipipatli boiled in water atole, chia, tortilla, xalxocotl fruit, and leaves to ease symptoms. The theory of the four humors states that the substances that make up the human body are: black bile, yellow bile, blood, and phlegm. Another component to this theory is that each substance had an associated color, temperature, and moisture classification. The medieval scholars who proposed this theory even tried to associate the humors with the fundamental elements, based on the idea that we need to consume them in order to survive. So each item had another classification of being either hot/cold and moist/dry. This influenced the European treatments but not the indigienous ones because the indigeinous had already been adopted and practiced methods. They had managed to find healing properties of herbs and the effects of preparing them differently to get different remedies that the Europeans never had heard of or seen.

4. **The Inquisition, the Catholic Church, and Scientific Traditions** Discuss several examples of the following: (a) Catholic censorship of knowledge flowing from Europe to Latin America (b) Catholic censorship of knowledge flowing from Latin America to Europe (c) contributions to Latin American science by Catholic scholars and explorers (d) knowledge that was recorded or translated from indigenous sources by Catholic priests, monks, or nuns.

During the renaissance and scientific revolution, new ideas were emerging rapidly which posed questions regarding the ideas and principles of life taught and instilled by the church and crown. As a way of censoring what was being taught to the people, they outlawed the work of certain authors including Voltaire and Rousseau. Rousseau's social contract was feared by the church because he ignited new political and ethical thinking into the world. He made it evident that following the church or crown wasn't necessary to have a successful civilization. Furthermore, Isaac Newton made great strides in the area of advanced chemistry, discovery of the universal force of gravity, and laws of motion. His colleague Edmond Halley made the discovery that the sun essentially was the center of the universe and the Earth traveled around it. With these teachings, it allowed people to develop the skill of critical thinking. Since they went against the bible and previous reasonings for the way the world functioned, in order to spread the news of this knowledge, people would smuggle in books to the Spanish viceroyalties. Smuggling of books and translation of them became a common practice. However, not only was the church trying to censor knowledge from Latin America, Europeans were also attempting to withhold the discoveries of herbal remedies and medicines made in Latin America from Europe. This was due to the fact that they didn't necessarily understand all the repercussions and how to properly handle the process of the indigenous treatments. They feared the behaviors and almost psychedelic effects that sometimes coincided with the use of indigenous herbs for healing/medicinal purposes if not used properly. Although censorship was vast, this did not stop Catholic scholars and explorers from conducting their own research. Jose Antonio Alzate y Ramirez was a Catholic Priest that wrote books surrounding the topics of meteorology, physics, astronomy, math, and indigenous history. One being "Observación del paso de Venus por el disco del Sol" in which he predicted an aurora that would be observable from different countries around the world. Another example of a Catholic Scholar making contributions to Latin American science was Antonio de Leon y Gama who was a lawyer that discovered two important anthropological items, La Coatlicue which was an intact statue of "the mother of Gods" and La Pierda del Sol, a calendar stone that led to the understanding of how the Aztec calendar worked. He also aided in the discovery of the aurora and concluded that altitude and the moon's phases were correlated with it. Some of the knowledge that was recorded/translated from indigenous sources by catholic clergy members where the Nahult medicine recipes and remedies. They were translated to Spanish by the Jesuit missionaries. This benefited the Europeans because the Nahult had treatments to cure syphilis that were effective.