Gabriella Tellez
ID#: 001226503

50/50

I'm proud of you!

Midterm - INTD290

Dr. Jordan Hanson - Whittier College Dept. of Physics and Astronomy

February 4, 2021

1 How to Submit this Midterm

1. Complete your work on this midterm.
2. Scan it into PDF form using a smartphone app, scanner, or digital picture
3. Alternatively you can type up your answers in a separate file, but it still must be a PDF
4. Submit it using the link on Moodle

2 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 ✓
2. Which of the four *virreinatos* excelled at the exportation of rum? C ✓
3. Which of the four *virreinatos* was characterized by an indigenous empire that mastered agriculture in the Andean mountains? A ✓
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. Mexico city, Hidalgo, Guadalajara, Guanajuato These cities located in (B) Nueva España. Aurora also spotted in San Luis Potosí, Cuba & Hawaii. ✓
5. List some of the locations explored by La Condamine and his Latin American collegues, and cite the virreinato or virreinatos they explored together. City of Quito, Colombia, Panama & Ecuador. Virreinato de Nueva Granada (C) ✓
6. The Expedición Botánica of José Celestino Mutis took place in which virreinato? C ✓
7. José 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) Nueva Granada city: Bogotá ✓
8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been in the 18th century?
   the Pierre Auger Observatory is located in Argentina.
   Virreinato (D) Río de la Plata ✓

excellent

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.

3 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.

• This physics detector is called the High Altitude Water Cherenkov detector (HAWC) This detector is utilized to detect radiation that is located in the shower of the gamma rays. This detector is located at a high altitude and are constructed through numerous aligned tanks that each contain water and within the water are sensors aiming to detect the UV light. The tanks' alignment will detect direction through geometry & quantity accuracy will benefit from position on the mountain

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 along with Iglesia Real de Catorce were supplemental locations identified as mining towns. Due to their geographical location remaining down on a valley surrounded by mines implemented the need for educational mining institutions in the 18th century. These locations at the time reflected economic powerhouses as they provided scientific and technical instruction for miners, mine owners and the overall community

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 originate, and how was it shipped to Europe and Africa?

Potosi is being shown which is a city in Bolivia. This city is extremely important as a mining history originates from Cerro Rico. Potosi supplied the world with silver and was at some point controlled by the Habsburg Empire. Silver was loaded onto mules for the trans-Andean trek to the Pacific port of Africa or taking 4/6 months to Buenos Aires

well done

4 Asynchronous Activity Review II

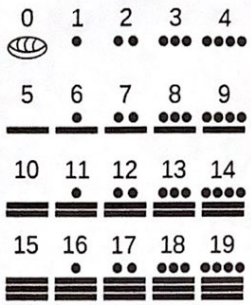
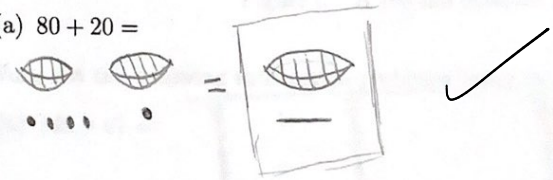


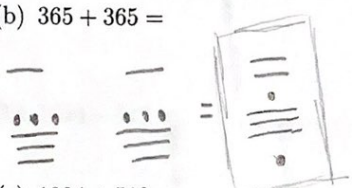
Figure 4: A list of the numerical digits used by the Maya.

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

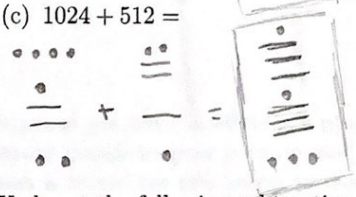
   (a) $80 + 20 =$

   (b) $365 + 365 =$

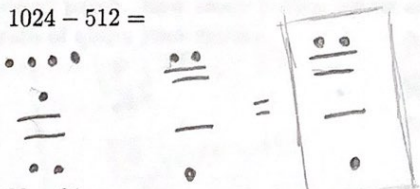
   

   (c) $1024 + 512 =$

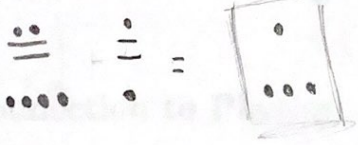
   

2. Work out the following subtraction problems *using the Mayan system.*

   (a) $1024 - 512 =$

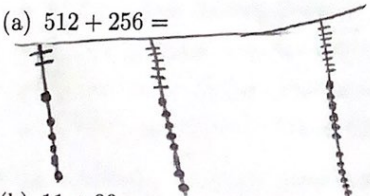
   

   (b) $92 - 31 =$

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

   (a) $512 + 256 =$

   (b) $11 + 89 =$

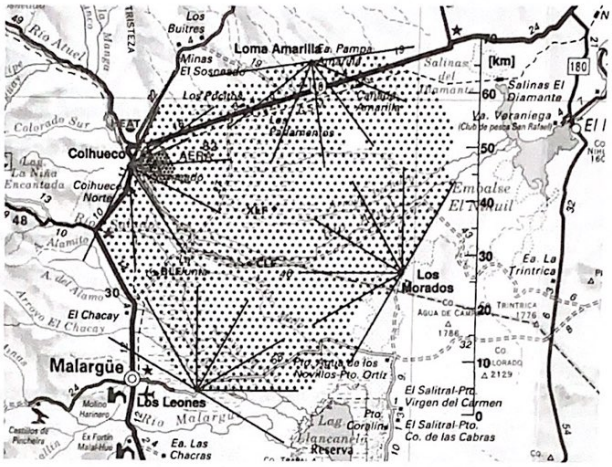
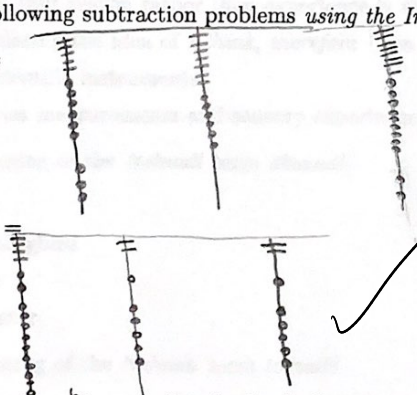


Figure 5: A physics detector near Malargüe, Argentina.

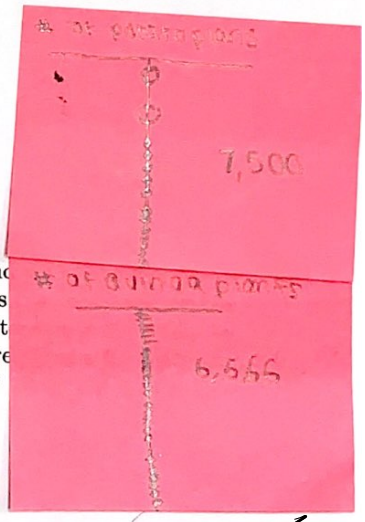
4. Work out the following subtraction problems *using the Incan quipu*

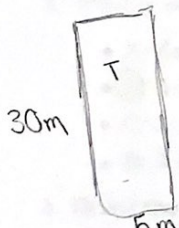
(a) $365 - 67 =$

(b) $1024 - 512 =$



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





P .2m ⇒ 2T
.2m

Q .3m ⇒ 4T
.3m

Area of Terrace: 150 m²
Area of Potato plant: .04 m²
Area of Quinoa plant: .09 m²

2 (150 / (.04)) = # of potato plants → 7,500 potatos

4 (150 / (.09)) = # of quinoa plants → 6,666 quinoas

5 Connection to Physics

nice!

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?

C
   - A: To collide protons and nuclei to probe sub-atomic physics
   - B: To detect signals from neutrinos that originate outside the solar system
   - C: To detect cosmic rays that originate outside the solar system

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

6 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 País*, 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

7 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 Perú in the late 18th century.

Acceptance of new scientific ideals was very environmental influenced. In Nueva Granada, Mutis taught Newtonian physics in University like of Santafe, Caracas & Quito. Mutis & the Dominican Congregation of Santa fe de Bogotá was very important as it developed controversy regarding rival philosophical concepts along with different social & political concepts. When the Jesuits were thrown out of Spanish territory teachings were highly effected in universities especially in the city of Quito. Years later when the Dominicans recovered their power & privileges in institutions scientific activity and Newtonian theories were encouraged in the royal botanical gardens & the schools of mining. Quito's public University was one of the last institutions to encourage Enlightenment teachings.

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.

An aurora is a natural phenomenon characterized by a display of a natural-colored light in the sky. The colors of the aurora correspond to solar electrons interacting with various gases in the atmosphere. Alzante y Ramírez predicted the aurora would have been observed in other countries including Spain & Russia. Spanish countries proved them to be correct. Alzante y Ramírez also collected observations from multiple cities to calculate the geometry of the ring. Leon y Gama concluded that they were higher than the atmosphere. Sir Edmond Halley thought that the magnetized matter was radiating from the poles of the Earth.

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.

The four humors was a medieval theory of medicine based on four classes of fluids within the body with an associated color that each had a temperature and moisture classification. These four elements were classified as hot/cold & moist/dry. Some examples of treatments include Ezipipatli which treated diarrhea. Another example would be how chocolate helped bowel movements, urination. Phlebotomy & Cupping were other forms of treatments as well. Cacao was a very complex treatment in relation to the 4 humors theory applying cacao in different aspects of utilization. The 4 humors theory also explains treatments through the imbalances of ailments in the body.

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.

a) Some examples regarding catholic censorship of knowledge flowing from Europe to Latin America would be how in Mexico in 1764 the Inquisition prohibited reading of Voltaire and Rosseau. Another example would be how the church referenced to the bible to theoretically explain the structure of the universe rather than physics. "Bible"

b) Some examples of catholic censorship flowing from Latin America to Europe would be indigenous treatments where objects/elements were praised for their purpose like Quipo that would interfere with religious practices. Other forms of treatments that also involved elements to cast away demons were also an issue as it opposed religious practices.

c) Some contributions to Latin American science by catholic scholars & explorers include how Alzante was a priest in the church and how the church confiscated his journals because his journals discuss the physics of the sun, charged particles and more scientific ideals.

d) Knowledge that was translated from indigenous sources by catholic priests were how Nahtual medicine was translated by Josuit priests into spanish.