

TASK CARD: CAESAR CIPHERS

1) Some Background Information

With a Caesar Cipher, you replace each letter in a message with a letter further along in the alphabet. A Caesar cipher shifts the alphabet and is therefore also called a shift cipher. The key is the number of letters you shift. Caesar cipher is one of the oldest types of ciphers. It is named after Julius Caesar, who is said to have used it to send messages to his generals over 2,000 years ago. It is the easiest cipher to crack.

2) Some Vocabulary to know:

Encrypt or Encode: To convert plain text into code or a cipher

Decrypt or decode: to convert a cipher or unclear message into plain text

plain text: text that is readable and not encoded

cipher: a secret or disguised way of writing; a code

3) Create a Cipher Wheel

- a. Cut out the two wheels provided and poke a brad (paper fastener) through the center of each so that it will spin. Use this to complete the following activities.

4) Complete Caesar Ciphers: Encrypting and Decrypting/More Decrypting/and More Encrypting

- a. Do not move on until you have completed all three pages.
- b. Use the cipher wheel to help you decrypt/encode

5) Caesar Ciphers: Cracking

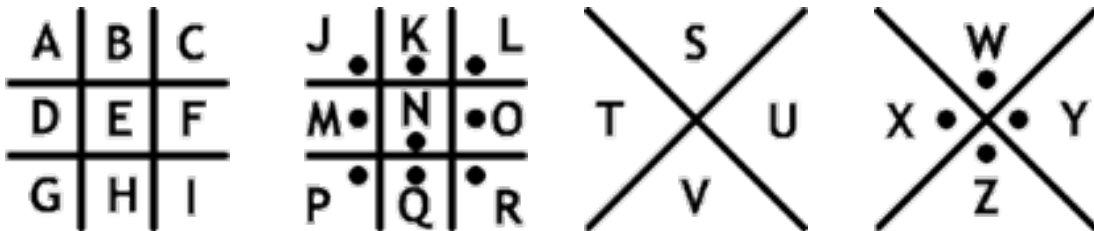
- a. Cracking a code is different than simply decrypting or decoding. When you crack a code you do not have a key to start with. You must use your knowledge of the English language to help you find a key.
- b. Things to look for are letter frequencies. E is the most commonly used letter in the English language, followed by T and A.
- c. Look for common double letters
- d. Look for single letter words such as I or A.
- e. Complete the Caesar Ciphers: Cracking sheet
- f. On the back of this sheet list (in sentence format) the pro's and con's of using the Caesar Shift Cipher.

TASK CARD: PIGPEN CIPHERS

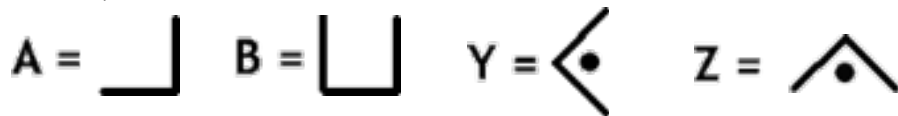
The Pigpen Cipher is another example of a substitution cipher, but rather than replacing each letter with another letter, the letters are replaced by symbols. The cipher has an interesting history: although its true origins are unknown, it has been used by many groups. Most notoriously, it was the cipher of choice for use by the Freemasons, a secret society in the 18th Century. In fact, they used it so much, that it is often referred to as the Freemasons Cipher. However, it was not exclusively used by them, with Union prisoners in Confederate camps using it to communicate in the American Civil War. (<http://crypto.interactive-maths.com/pigpen-cipher.html#intro>)

Encryption

The encryption process is fairly straightforward, replacing each occurrence of a letter with the designated symbol. The symbols are assigned to the letters using the key shown below, where the letter shown is replaced by the part of the image in which it is located.



Here are some examples of this code:



- Use the Pig Pen key to work out what this Pig Pen message means:



Decode the message on a lined sheet of paper.

- Write a message to a friend in Pig Pen. Make it about a paragraph long on the same sheet of paper you used for #1. Then decode it.

The Beale Treasure Ciphers
The Guardian (1999)



The solved cipher

As a result of the media frenzy over this week's Hotmail debacle, it would be easy to overlook another major story that concerned security on the Internet. On August 22, a vast team of researchers from Britain, the Netherlands, France, Canada and America announced that they had cracked a code known as RSA-155, the sort of encryption that can be used to protect e-mails and financial transactions on the Internet. However, the breaking of RSA-155 does not demonstrate the weakness of current encryption methods, but rather their strength. First of all, it took the international collaboration over three months to crack the code. Furthermore, RSA-155 is a crippled version of the standard RSA encryption

system, one that is effectively unbreakable, and one that is used routinely for encrypting messages on the Internet.

RSA Data Security Inc. had created the RSA-155 encrypted message especially for code-breakers, in order to test the current state of code-breaking technology. Had they encrypted a message using full-strength RSA, then nobody one have broken it, and RSA Data Security Inc. would not be able to gauge the potency of new code-breaking techniques. As an incentive to tackle RSA-155, the company offered a prize of around \$10,000, and now that the money has been won, they will set a new challenge with a new prize. However, code-breakers who are looking for the ultimate challenge might like to tackle an, as yet, un-cracked code from the 19th century. Whoever unravels the so-called Beale ciphers will earn a reward of over £10 million in gold, silver and jewels.

The story of the Beale ciphers begins in January 1820, when a stranger by the name of Thomas J. Beale rode into the town of Lynchburg, Virginia, and checked himself into the Washington Hotel.

"In person, he was about six feet in height," recalled Robert Morriss, the hotel owner, "with jet black eyes and hair of the same color, worn longer than was the style at the time. His form was symmetrical, and gave evidence of unusual strength and activity; but his distinguishing feature was a dark and swarthy complexion, as if much exposure to the sun and weather had thoroughly tanned and discolored him; this, however, did not detract from his appearance, and I thought him the handsomest man I had ever seen."

Although Beale spent the rest of the winter in Lynchburg and was "extremely popular with every one, particularly the ladies," he never spoke about his background, his family and the purpose for his visit. Then, at the end of March, he left as suddenly as he had arrived.

Beale returned two years later, and once again he spent the rest of the winter in Lynchburg and disappeared in the spring, but not before he entrusted Morriss with a locked iron box, which he said contained "papers of value and importance." Morriss dutifully guarded the box, waiting for Beale to collect it, but the swarthy man of mystery did not return to Lynchburg. He disappeared without trace, never to be seen again.

Eventually, 23 years later in 1845, Morriss's curiosity got the better of him and working on the assumption that Beale was dead, he cracked open the locked box. Inside he found a note written by Beale in plain English, and three sheets full of numbers. The note revealed the truth about Beale, the box, and the ciphers. In April 1817, almost three years prior to his first meeting with Morriss, Beale and twenty-nine others had embarked on a journey across America. After traveling through the rich hunting grounds of the Western plains, they arrived in Santa Fe, before heading north in search of buffalo. Then, according to Beale's note, they struck lucky: "The party, encamped in a small ravine, were preparing their evening meal, when one of the men discovered in a cleft of the rocks something that had the appearance of gold. Upon showing it to the others it was pronounced to be gold, and much excitement was the natural consequence."

The note went on to explain that Beale and his men mined the site for the next eighteen months, by which time they had accumulated a large quantity of gold, as well as some silver which was found nearby. In due course, they agreed that their new found wealth should be moved to a secure place, and decided to take it back home to Virginia, where they would hide it in a secret location. To reduce the weight, Beale traded some of the gold and silver for jewels, and in 1820 he travelled to Lynchburg, found a suitable location, and buried the treasure. It was on this occasion that he met Morriss for the first time.

When Beale left at the end of the winter, he rejoined his men, who had continued to work the mine during his absence. After another eighteen months, Beale revisited Lynchburg with even more to add to his stash. This time there was an additional reason for his trip. His companions were concerned that, in case of an accident to themselves, then the hidden treasure would not find its way to their relatives. Hence, Beale was instructed to find a reliable person, who could be confided in to carry out their wishes in the event of their sudden death, and Beale selected Morriss to be that person.

Upon reading the note, Morriss felt responsible for finding the treasure and passing it onto the relatives of the presumably dead men. Unfortunately, there was a problem. The description of the treasure, its location, and the list of the relatives had been encrypted,

and had been transformed into the three sheets that contained nothing but numbers. Beale's note said that the key required to decipher the sheets would be posted to Beale by a third party, but it never materialized, and so Morriss was forced to unscramble the three sheets from scratch. This task occupied his mind for the next twenty years, and ended in complete failure.

In 1862, at the age of 84, Morriss knew that he was coming to the end of his life, and realised that he had to share the secret of the Beale ciphers, otherwise any hope of carrying out Beale's wishes would die with him. Morriss confided in a friend, but unfortunately the identity of this person remains a mystery. Only two things are known about Morriss's friend. First, he published a pamphlet, which contains the entire Beale story, including the Beale ciphers and Morriss's account of the events surrounding the mystery. Second, the anonymous pamphleteer made the first breakthrough in deciphering one of Beale's cryptic papers.

The second Beale cipher, like the other two, contains about 800 numbers, beginning with the sequence; 115, 73, 24, 807, 37, ... The pamphleteer guessed that each number corresponded to a word in the Declaration of Independence. For example, the first number in the sequence is 115 – the 115th letter of the Declaration is 'instituted', which begins with the letter I. Hence the first number, 115, represents the letter I. The second number in the sequence is 73 – the 73rd word in the Declaration is 'hold', which begins with the letter H. Hence, the second number, 73, represents the letter H.

The Opening of the "Declaration of Independence"

When (1), in (2) the (3) course (4) of (5) human events it becomes necessary (10) for one people to dissolve the political bands which have (20) connected them with another, and to assume among the powers (30) of the earth, the separate and equal station to which (40) the laws of nature and of nature's God entitle them (50), a decent respect to the opinions of mankind requires that (60) they should declare the causes which impel them to the (70) separation. We hold these truths to be self-evident, and that (80) all men are created equal, that they are endowed by (90) their Creator with certain inalienable rights, that among these are (100) life, liberty and the pursuit of happiness; That to secure (110) these rights, governments are instituted among men...

By continuing this process, the pamphleteer revealed the following message from Beale:

"I have deposited in the county of Bedford, about four miles from Buford's, in an excavation or vault, six feet below the surface of the ground, the following articles: ... The deposit consists of two thousand nine hundred and twenty one pounds of gold and five thousand one hundred pounds of silver; also jewels, obtained in St. Louis in exchange for silver to save transportation ... The above is securely packed in iron pots, with iron covers.

The vault is roughly lined with stone, and the vessels rest on solid stone, and are covered with others ...”

The successful decipherment indicated the value of the treasure – at least £10 million at today’s bullion prices. Unfortunately, using the Declaration of Independence as a key failed to unlock the other two Beale ciphers. In particular, the pamphleteer could not decipher the sheet of numbers that described the location of the treasure. Not surprisingly, once the pamphleteer knew the value of the treasure, he spent increasing amounts of time analyzing the remaining Beale ciphers, but despite strenuous efforts he failed to make any progress. In 1885, he decided to unburden himself by publishing everything he knew, choosing to remain anonymous so as not to be pestered by eager treasure hunters.

Although a warehouse fire destroyed most of the pamphlets, those that survived aroused immediate interest. Among the most ardent treasure hunters attracted to the Beale ciphers were the Hart brothers, George and Clayton. They pored over the papers for decades, but Clayton Hart gave up in 1912, and George eventually abandoned hope in 1952. An even more persistent Beale fanatic has been Hiram Herbert, Jr., who first became interested in 1923 and who continued with his obsession right through to the 1970s. He, too, had nothing to show for his efforts.

Professional cryptanalysts have also embarked on the Beale treasure trail. Herbert O. Yardley, who founded the U.S. Cipher Bureau (known as the American Black Chamber) at the end of World War I was intrigued by the Beale ciphers, as was Colonel William Friedman, the dominant figure in American code-breaking during the first half of the 20th century. While he was in charge of the Signal Intelligence Service, he made the Beale ciphers part of the training program, because he believed the ciphers to be of “diabolical ingenuity, specifically designed to lure the unwary reader.” The Friedman archive, established after his death in 1969 at the George C. Marshall Research Centre, is frequently consulted by military historians, but by far the largest number of visitors are eager Beale devotees. More recently, one of the leading figures has been Carl Hammer, retired director of computer science at Sperry Univac and one of the pioneers of computerized code-breaking. According to Hammer, the Beale ciphers have occupied:

“At least 10 % of the best cryptanalytic minds in the country. And not a dime of this effort should be begrudged. The work – even the lines that have led into blind alleys – has more than paid for itself in advancing and refining computer research.”

The lack of success means that we cannot exclude the possibility that the Beale ciphers are an elaborate hoax. Skeptics have searched for inconsistencies and flaws in the Beale story. For example, Beale’s letter enclosed in the box with the ciphers was supposedly

written in 1822, but it contains the word "stampede", which was not seen in print until 1844. However, it is quite possible that the word was in common usage in the wild west at a much earlier date, and Beale could have encountered it on his travels.

Evidence in favor of the probity of the ciphers comes from historical research, which can be used to verify the story of Thomas Beale. Peter Viemeister, a local historian who showed me some of the places where treasure hunters have already looked, searched for evidence to prove that Thomas Beale existed. Using the census of 1790 and other documents, Viemeister has identified several Thomas Beales, who were born in Virginia and whose backgrounds fit the few known facts. Most of the details we have about Beale concern his trip to Sante Fe, and there is evidence to corroborate his discovery of gold. For example, Jacob Fowler, who explored the American southwest in 1821-22, noted in his journal that the Pawnee and Crowe tribes "speake on the most friendly terms of the White men and say they are about 35 in number" – this number is similar to the size of Beale's party. Also, there is a Cheyenne legend dating from around 1820 which tells of gold and silver being taken from the West and buried in Eastern Mountains.

Consequently, the tale of the Beale ciphers continues to enthrall code-breakers and treasure hunters. However, anybody who might be tempted to take up the challenge of the Beale ciphers should take heed of some words of caution given by the author of the pamphlet:

"Before giving the papers to the public, I would give them a little advice, acquired by bitter experience. It is, to devote only such time as can be spared from your legitimate business to the task, and if you can spare no time, let the matter alone ... Never, as I have done, sacrifice your own and your family's interests to what may prove an illusion; but, as I have already said, when your day's work is done, and you are comfortably seated by your good fire, a short time devoted to the subject can injure no one, and may bring its reward."

<http://simonsingh.net/media/articles/maths-and-science/the-beale-treasure-ciphers/>

Task Card: The Beale Cipher

- 1) Read the enclosed background story about the Beale Cipher. It is really fascinating!
- 2) On a blank sheet of lined paper write a paragraph describing Morriss' journey with the encoded text that he found in the box. Discuss how it must have felt on that journey. What do you think the pages that were missing told? Is this a journey you would want to take? Why or why not?
- 3) Decode (decrypt) the following message. Key:
Fablehaven: Chapter 1

14,37,54,73,93,100,62,54,19,82,52
,134,138,119,97,89,1107,363,152,
195,323,55,210,281

- 4) Now, create your own Beale Cipher using the document/text provided. Your cipher must be at least 10-20 words long. Write the cipher out on a blank sheet of paper and provide a key. If you want to use another text source let the teacher know.

Chapter 1 of Fablehaven Keys to the Demon Prison

Chapter One

A Dying Wish

Seth knew he should not be here. His grandparents would be furious if they found out. The dismal cave smelled more rancid than ever, like a nauseating feast of spoiled meat and fruit. Almost steamy with humidity, the wet air forced him not only to smell but also to taste the putrid sweetness. Every inhalation made him want to retch.

Graulas lay on his side, chest swelling and shrinking with labored, hitching breaths. His infected face rested against the rocky floor, inflamed flesh flattened in a sticky mass. Although the demon's wrinkly eyelids were shut, he twitched and grunted as Seth drew near. Groaning and coughing, the bulky demon peeled his face away from the floor, one curled ram horn scraping the ground. The demon did not fully arise, but managed to prop himself up on one elbow. One eye opened a fraction. The other was fused shut by congealed goo. (151)

"Seth," Graulas rasped, his formerly rumbling voice weak and tired.

"I came," Seth acknowledged. "You said it was urgent."

The heavy head nodded slightly. "I . . . am . . . dying," he managed.

The ancient demon had been diseased and dying since Seth had first met him. "Worse than ever?" (197)

The demon wheezed and coughed, a cloud of dust rising from his lumpy frame. After spitting out a thick wad of phlegm, he spoke again, his voice little more than a whisper. "After . . . long years . . . of dwindling . . . my final days . . . have arrived."

Seth was unsure what to say. Graulas had never tried to hide his nefarious past. Most good people would be relieved to hear of his demise. But the demon had taken a liking to Seth. After becoming intrigued by Seth's unusual exploits and successes, Graulas had helped him figure out how to stop the shadow plague, and had further assisted him in learning to use his newfound abilities as a shadow charmer. Whatever crimes Graulas may have committed in the past, the moribund demon had always treated Seth well. (328)

"I'm sorry," Seth said, mildly surprised to find he really meant it.

The demon trembled, then his elbow collapsed and he flopped flat against the ground. His eye closed. "The pain," he moaned softly. "Exquisite pain. My kind . . . dies . . . so very slowly. I thought . . . I had sampled . . . every possible agony. But now, it burrows . . . twists . . . gnaws . . . expands. Deep inside. Relentless. Consuming. Before I can master it . . . the pain increases . . . to new plateaus of anguish." (402)

"Can I help?" Seth asked, doubting whether anything from the medicine cabinet would do the trick.

The demon snorted. "Not likely," he panted. "I understand . . . you will leave tomorrow." (506)

"How did you know that?" His mission the next day was supposedly a secret.

"Confide . . . no plans . . . to Newel and Doren."

Seth had not provided the satyrs with details. He had just told them he would be leaving Fablehaven for a time. He had been at the preserve for more than three months, ever since he and the others had returned from Wyrmoost. He had enjoyed several adventures with Newel and Doren in the interim, and felt he owed them a good-bye. Grandpa would only let them discuss the mission in his office with spells to help prevent spying, so Seth had shared no specifics, but he probably should not have said anything at all to the satyrs. "I didn't give them details," he told Graulas. (634)

"No . . . but I heard them mention your departure . . . as they moved about the woods. Although . . . I can't see into your house . . . I can deduce . . . you seek another artifact. Only such . . . a mission . . . would prompt Stan to risk . . . your safety."

"I can't really talk about it," Seth apologized.

Graulas coughed wetly. "The details are unimportant. If I heard and guessed . . . others may have heard. Though I cannot . . . see . . . beyond the preserve . . . I can sense much outside attention focused here. Mighty wills straining to spy. Be on your guard." (721)

"I'll be careful," Seth promised. "Is that why you called me here? To warn me?"

One eye cracked open and a faint smile touched the demon's desiccated lips. "Nothing so . . . altruistic. I am soliciting a favor."

"What?"

"I may . . . expire . . . before you return. Which would render my wishes . . . irrelevant. After all this time . . . my days are truly numbered. Seth . . . not only . . . my physical pain . . . troubles me. I am afraid to die."

"Me too."

Graulas grimaced. "You do not understand. Compared to me . . . you have little to fear."

Seth scrunched his brow. "You mean because you were bad?" (818)

"If I could . . . evaporate . . . into nothing . . . I would welcome death. But this is not the case. There are other spheres awaiting us, Seth. The place prepared for my kind . . . when we exit this life . . . is not pleasant. Which is partly why demons cling to this life for as long as we can. After how I lived . . . for thousands of years . . . I will have to pay a steep price."

"But you're not the person you were," Seth said. "You've helped me a lot! I'm sure that will count for something." (907)

Graulas huffed and coughed differently than he had before. It almost sounded like a bitter chuckle. "I meddled with your dilemmas . . . from my deathbed . . . to amuse myself. Such trivialities will do little to offset centuries of deliberate evil. I have not

changed, Seth. I am merely powerless. I have no drive left. As much pain as I am now enduring, I fear that the afterlife . . . will hold far greater agonies."

"So what can I do?" Seth wondered. (984)

"One thing only," Graulas growled through clenched lips. His eye squinted shut and his fists tightened. Seth heard teeth grinding. The demon's breath came in sharp, ragged bursts. "One moment," he managed, trembling. Creamy tears oozed from his eyes.

Seth turned away. It was too much to watch. He had never imagined such misery. He wanted to run from the cave and never return.

"One moment," Graulas gasped again. After a few grunts and moans, he began to breathe more deeply. "You can do one thing for me."

"Tell me," Seth said. (1076)

"I do not know the purpose of your mission . . . but should you recover the Sands of Sanctity . . . that artifact could greatly alleviate my suffering."

"But you're so diseased. Wouldn't it kill you?"

"You're thinking of . . . the unicorn horn. The horn purifies . . . and yes . . . its touch would slay me. But the Sands heal. They wouldn't just burn away my impurities. The Sands would cure my maladies and help my body survive the process. I would still be dying of old age, but the pain would be lessened, and the healing might even buy me a little more time. Forgive me, Seth. I would not ask . . . were I not desperate."

Seth stared at the pathetic ruin the demon's body had become. "The Sphinx has the Sands," he said gently.

"I know," Graulas whispered. "Even the thought . . . that there is some small chance . . . gives me something to dwell upon . . . besides . . . besides . . ."

"I understand," Seth said.

"I have nothing else to hope for."

"Of course we're trying to get the Sands back," Seth soothed. "I can't say this mission will do that, but of course we hope to recover all of the artifacts. If we can get the Sands of Sanctity, I'll bring the artifact here and heal you. I promise. Okay?"

Discolored tears gushed from the eyes of the demon. He turned his face away. "Fair enough. You have . . . my thanks . . . Seth Sorenson. Farewell."

"Is there anything else I can—"

"Go. You can do nothing more. I would rather not . . . be seen . . . like this."

"Okay. Hang in there."

Flashlight in hand, Seth exited the cave, relieved to leave behind the humid stench and the naked agony. (1349)

Chapter Two

Obsidian Waste

Kendra reclined in the comfy seat and tried to doze, but despite the hypnotically steady whine of the private jet's engines, she could not calm her mind. A string of flights had taken her, Tanu, and Seth from New York to London, then to Singapore, and finally to Perth, the capital of Western Australia, where they had boarded the private jet they currently occupied. At the various airports along the way, Tanu had them ducking into bathrooms to change outfits and taking complicated routes through the terminals. They traveled under assumed names using false identification, all in the hope of avoiding the notice of their enemies in the Society of the Evening Star.

At Perth they had met up with Trask, Mara, Elise, and a guy named Vincent. Trask sat across the aisle from Kendra, filing his nails, his dark scalp gleaming. She was glad he was leading the mission. Her past experiences with him had shown that he remained calm under duress, and he was widely considered the most seasoned field operative among the Knights of the Dawn.

Directly in front of Kendra, Tanu leaned against a window, snoring gently. The Samoan potion master had spent more time asleep than awake on their previous flights. Despite his bulk, he had a knack for dozing on planes. Kendra wished she had asked him for a concoction to help her relax.

Elise reclined behind Kendra, listening to music on a pair of noise-canceling headphones. She had new red streaks in her hair and wore heavier makeup than when she had helped Warren guard Seth and Kendra back in December. Eyes closed, she softly tapped her fingers against her thighs to the beat.

At the front of the cabin, Mara gazed out the window. A tall, athletic woman with dramatic cheekbones, Mara hadn't been talkative even before the Lost Mesa preserve fell and her mother was killed. Since greeting them at the airport in Perth, the Native American seemed quieter than ever.

Vincent, the only member of the party Kendra had not met previously, sat across from Mara. A small man of Filipino descent, he smiled a lot and had a faint accent. Grandpa had explained that Vincent had been included on the mission because of his familiarity with the Obsidian Waste preserve.

Although she could not see him, Kendra knew that Seth was up in the cockpit with Aaron Stone, the same man who had piloted their helicopter when they went to Wyrmoost. Had that really been only three months ago? It felt like a lifetime.

She wished Warren were here with them. It felt wrong to go adventuring without him. He had been with her at the inverted tower at Fablehaven, as well as Lost Mesa and Wyrmoost. But now he was part of the reason this expedition was so urgent. At Wyrmoost, Warren had been trapped inside a magical chamber. The entrance to the room looked like a regular knapsack, but inside the unassuming mouth of the bag a series of rungs led down into a spacious storeroom heaped with junk and provisions. After Gavin had revealed himself as Navarog, he had destroyed the knapsack, stranding Warren inside the storage room along with a small hermit troll named Bubda. (1891)

The room had been well stocked with food and water, but any supply was finite, and now, after three months, Grandpa and the others had estimated that Warren would be nearly out of rations. Without prompt intervention, starvation would claim him.

Not long after Kendra had returned to Fablehaven from Wyrmoost, Coulter Dixon had embarked on a campaign to discover how the Translocator functioned. The adventure at Wyrmoost had provided them with the key to the vault at Obsidian Waste, but obtaining the Translocator would be much more useful if they knew how it exerted power over space. Otherwise, it might end up like the Chronometer, a powerful artifact that they had little idea how to operate.

After exploiting his best contacts and hunches, the veteran relic hunter had returned with no new information. Kendra had never seen Coulter looking so old and defeated. Others kept searching for operational guidelines, but a couple of weeks ago, it was Vanessa who finally reported success. She had been mentally traveling out of Fablehaven into the sleeping minds of people she had bitten in the past. Her primary focus had been trying to figure out where Kendra's parents had been taken, but while working with one of her contacts inside the Society of the Evening Star, the narcoblix had uncovered long-guarded information about operating the Translocator. Once Coulter had verified that the intelligence seemed authentic, the Knights had started planning this mission, in the hope that the Translocator could help them rescue Warren and gain a new advantage over the Society.

Kendra also quietly hoped that an artifact as powerful as the Translocator might help in the search for her mother and father. Marla and Scott Sorenson had known nothing about disguised magical creatures existing in the real world. And yet, despite their lack of involvement in the affairs surrounding Fablehaven, contrary to all precedent, they had been abducted. Stranger still, there had been no contact from the Society about terms for their release. After Wyrmoost, the Sphinx and the Society had seemed to disappear.

Kendra tried not to dwell on her parents. The thought of them made her ache. Scott and Marla both still believed she was dead. They had held a funeral and buried a duplicate Kendra and then had been abducted before the record could be set straight. A miserable emptiness overcame Kendra whenever she remembered that her parents believed their daughter to be dead and buried. All of that futile grief! Now that her parents were prisoners, would they ever learn the truth?

To make matters worse, her parents had been taken through no fault of their own. They had never even heard of the Society of the Evening Star. Kendra, Seth, and maybe Grandma and Grandpa Sorenson were the ones to blame. The abduction had to be in retaliation for Navarog's failure at Wyrmoost. The thought of her beloved parents paying for her decisions made Kendra want to scream her way to insanity.

To combat the grief, Kendra usually let it flare into hatred, a fiery coal bed of wrath that grew hotter over time, fueled by fear and fanned by guilt. Almost all of that hate was directed toward a single individual: the Sphinx.

It was the Sphinx who had waged war on the preserves for magical creatures, trying to steal the five secret artifacts that together could open the demon prison Zzyzx. It was the Sphinx who had introduced her to Gavin, a cute guy and a good friend who had turned out to be a scheming, demonic dragon. It was the Sphinx who had initiated the shadow plague, which had led to the death of Lena. It was the Sphinx who had kidnapped her and forced Kendra to use the Oculus, an artifact with amazing powers of sight that had almost devoured her mind. (2532)

And it was the Sphinx who was still out there, unpunished, with her parents under his control, plotting further mischief that could lead to the opening of Zzyzx and the end of the world.

At least now she was an active part of the effort to deal the Sphinx a major blow and hopefully help Warren and her parents in the process. After months of wait and worry, it felt good to be doing something, even if it was dangerous. Under tutelage from Tanu, Coulter, and occasionally Vanessa, she and Seth had trained with swords, bows, and other weapons over the past few months, so she felt more empowered than ever. Nevertheless, although she and Seth were now both full-fledged Knights of the Dawn, she had been surprised when Grandpa, as Captain of the Knights, had included them on such a risky mission. In the end, the essential roles their abilities had played on past assignments had won out. Their presence underscored the desperate need for success.

Kendra yawned, trying to get her ears to pop. The plane was descending. Trask unbuckled his seat belt, rose, and retrieved Seth from the cockpit. As Seth found a seat, Trask stood at the front of the cabin to address everyone.

"We'll be landing in about fifteen minutes," he announced. "I've set up several spells to prevent outside eyes and ears from spying. The magic should divert anything short of the Oculus. Now would be an appropriate time to review our mission."

Trask paused, brooding eyes roving the cabin. He cleared his throat. "Most of us have worked together before, so we'll skip introductions, except for Vincent, who is a new face to some of us, though not to me."

"I'm Vincent," the Filipino man said, half rising from his seat. "I'll be your guide at Obsidian Waste. Over the past ten years, I have spent several months there."

"How do we know you're not a monster in disguise?" Seth asked bluntly.

Vincent gave a weak chuckle. "I know we've all been dealing with unprecedented betrayals lately. The Knights of the Dawn have never seen infiltration and upheaval like the past year has provided. But as Trask can attest, I'm a Knight to the core, have been since my teenage years, when my parents were murdered by the Society."

"Trust has been running thin lately," Trask acknowledged, "but I'd let Vincent watch my back any day. Part of the reason this particular group was assembled was because we have been through enough together to trust each other. I have no doubts or hesitations that Vincent belongs in this circle of trust."

Kendra gazed at Vincent. She was glad her brother had spoken up. She wanted to believe Trask. But what if Trask himself was a traitor, patiently waiting for that vital, heartbreaking opportunity? Probably not. But Kendra had learned that "probably" wasn't always good enough. From now on, she wanted to be ready for anything.

"Our object is to retrieve the Translocator," Trask continued. "I have withheld some of the specifics until now. We believe we understand how the artifact functions. If our intelligence is correct, the device can transport an individual to anyplace he or she has visited previously."

Elise raised a hand. "Can it take passengers?" (3079)

Trask gave a nod. "Thanks to Vanessa and Coulter, we understand it can transport up to three people, along with their belongings. The device is a platinum cylinder, set with jewels, divided into three rotating sections. The user twists the sections to bring the jewels into alignment, activating the artifact. Whoever holds the center section controls the destination, and needs to focus mentally on that location as the other sections slide into place. Each intended traveler would grasp a different section."

"What if not all the passengers have been to the destination before?" Seth asked.

Trask shrugged. "Based on the recovered information, Coulter thinks only the person gripping the center section needs to have been to the desired location. But we won't be sure until we test it out."

"What if you teleport into solid rock?" Seth asked. "Or a hundred feet into the air? Or in front of a speeding train?"

The jet shuddered momentarily, and Trask raised a hand to brace himself until the turbulence passed. "The device carries unknowable risks, but given the sophistication of these artifacts, we can reasonably assume that the Translocator was designed to minimize those dangers."

Elise raised a finger. "We'll go into the vault tomorrow?"

"The plan is quick in, quick out," Trask confirmed. "We'll spend the night at the main house to get over our jet lag, then proceed to the vault in the morning. Hopefully, by tomorrow evening, we'll be flying home."

"If the artifact works right," Seth pointed out, "maybe we can skip the flight home."

Trask's mouth twitched and his eyes smiled. "We'll see. Our first order of business will be to make preparations at the main house tonight."

"Do we know where the vault is located?" Kendra asked. "The vaults at Fablehaven and Lost Mesa were well hidden."

Vincent answered. "The vault at Obsidian Waste gave the preserve its name—an immense monolith of obsidian overshadowing the surrounding plain. We know the location of the vault, and even where to place the key. But no rumors hint at what dangers await inside."

"Since the vault is so obvious," Trask said, "we must be prepared for the traps inside to be all the more deadly."

"The lack of camouflage may be related to the strength of the obsidian," Vincent observed. "We're not talking about regular stone. Over the years, there have been numerous attempts to drill, chisel, and blast entrances to the vault. So far nobody has scratched it."

"Why hide when you're invincible?" Elise muttered.

The intercom from the cockpit interrupted. "We're on final approach," Aaron announced. "The air is a little choppy, so I'm going to recommend you all take your seats for the duration." (3529)

"I'll pass around some walrus butter to make sure our eyes are open to the magical creatures of Obsidian Waste," Trask said. "We'll speak more at the house." He returned to his seat as a prolonged vibration rattled the aircraft.

Kendra didn't need magical milk or walrus butter to pierce the illusions that shielded most magical creatures from mortal eyes, so she passed it back to Elise without sampling any. Kendra checked her seat belt and peered out the window. Down below, the shadow of the jet fluttered over uneven ground. She observed mostly flat terrain, with scrubby bushes, low ridges, and shallow ravines. A pair of jeeps caught her eye, the vehicles kicking up dust as they moved along a dirt road on a diagonal course to intercept the descending jet. She was low enough to see a figure driving each open-topped jeep, but their features were unclear.

Gazing along the road behind the jeeps, Kendra noticed a wall. Actually, it was more the idea of a wall. At regular intervals, pyramids of stones stood in lonely piles, stretching away from the road in opposite directions. Nothing connected the rock piles, so they formed a boundary without creating an actual barrier. But Kendra recognized a shimmer in the air above the line formed by the rock piles, and she realized that it must be the distracter spell shielding Obsidian Waste.

Beyond the orderly stacks of stone, Kendra could see the sweeping loops of a meandering river, and, in the distance, a huge black stone shaped like a shoe box, its rectangular lines unnaturally regular. A tremor ran through the aircraft, and for a moment the jet wobbled sickeningly left and right. Kendra turned away from the window, facing forward, her hands gripping the armrests. The plane bucked and shuddered again. Kendra felt the tingling sensation that accompanies the initial plunge of a fast elevator. She had never been on a flight with this much turbulence!

Glancing across the aisle, she saw that Trask appeared unperturbed. Of course, he was tough to ruffle, and would probably wear that same impassive expression if the airplane disintegrated and his seat were plummeting alone toward the outback. The thought made Kendra smile.

Despite a few more bumps and jiggles, a minute or two later, the private jet landed smoothly. After taxiing shortly, the aircraft came to a stop. Kendra shouldered her backpack and waited while Tanu opened a door that swung out and down to become a short staircase. Kendra followed Seth down the steps. The isolated airstrip had a single runway, a ramshackle hangar, and a small office topped by a flapping wind sock.

After deplaning, Trask, Tanu, and Vincent started retrieving gear from the luggage compartment. Mara wandered off to one side and began a fluid routine of elaborate stretches. From the door of the plane, Elise studied the area through hefty binoculars. The sun hung high and bright overhead.

"Welcome to Australia," Seth announced in his best local accent, gesturing at their barren surroundings. After surveying the area for a moment, he frowned. "I expected more koalas."

"Which way to the baggage claim area?" Kendra asked.

Seth chuckled. "Not one of the fancier airports I've seen. This is more like some smuggler's hidden landing strip."

"What do they smuggle?" (4080)

"Boomerangs, mostly. And kangaroos. Poor little fellas."

"Here comes the welcoming crew," Elise reported. "Two vehicles, each with a single occupant."

Before long a pair of jeeps rumbled into view. Painted a military green, the rugged vehicles had oversized tires and growling engines. After the jeeps pulled to a stop beside the luggage compartment, the Indigenous Australian drivers climbed down. One was a young man, the other a young woman, both in their early twenties, - dark-skinned and long-limbed. The woman had white ribbons tied in her innovative hairdo.

Vincent charged over and greeted them with enthusiastic hugs. He was half a head shorter than the woman and a full head shorter than the man. Kendra and Seth drifted over for a closer look. Trask approached the drivers and shook hands with - them.

"I'm Camira," the woman said to everyone, "and this is my brother Berrigan. Don't pay any attention to him. His head is full of pudding."

"At least I'm not a know-it-all with a poisonous tongue," Berrigan replied with an easy smile, one hand resting on the large knife strapped to his waist.

"We're here to escort you to the house," Camira went on, ignoring her brother. "I suggest the ladies ride with me, or his smell might be the end of you."

"I recommend the guys ride with me," Berrigan agreed, "or you'll arrive at Obsidian Waste with no self-esteem."

"You two never stop going at each other," Vincent laughed. "You're exactly as I left you!"

"And you're still about the size of a termite," Camira teased, rising up on her - tiptoes.

Kendra noticed that Camira wore colorful sandals decorated with flashy stones. "I like your shoes."

"These?" Camira asked, holding up a foot. "I made them myself. They say I put the 'original' in 'Aboriginal.'"

"I say we should get on the road instead of chirping about footwear," Berrigan groaned. "These people are tired."

"Forgive my brother," Camira apologized. "We don't normally let him out of his cage when guests are present."

Working together, it did not take long to transfer the luggage to the jeeps. True to the drivers' suggestions, Trask, Tanu, Seth, and Vincent piled in with Berrigan, while Kendra, Elise, and Mara rode with Camira. Aaron stayed behind to perform maintenance on the jet.

Camira hit the gas hard, and her jeep roared onto the road first. Glancing back, Kendra saw the guys choking on their dust. Open-topped vehicles were not made for caravanning along dusty trails! (4507)

The jeep rocked and jounced as Camira sped along the imperfect road. She swerved to dodge the worst rocks and ruts, heedless of the huge plumes of dust kicked up by her wild maneuvers. The other jeep fell back, leaving room for some of the dust to dissipate before they passed through it.

Despite the bouncy ride, Kendra studied the arid landscape as best she could. The scraggly shrubs and barren rocks looked no more hospitable than the terrain surrounding the Lost Mesa preserve in Arizona. She supposed the people who had hidden these sanctuaries would have kept an eye out for unfriendly environments that might deter visitors.

Up ahead, the row of piled rocks came into view. Kendra did not mention the rocks or the shimmer in the air, because she knew that an ordinary person would not have been able to focus on them.

"Are you sure we're going the right way?" Elise shouted over the road noise.

"You're just feeling the effects of the distracter spell that shields the preserve," Camira answered. "I feel it too. We're on the right road. As long as I focus on staying on the road, we'll be fine. The sensation will pass once we're beyond the barrier."

Kendra felt no such effects, but she knew better than to reveal her immunity to a stranger. Sure enough, once they passed the row of rock piles, everyone in the jeep relaxed.

Beyond the rocks, the terrain became more welcoming. Wildflowers brightened the ground, the shrubs looked more robust, and trees came into view. Kendra saw a few mothlike fairies flitting around on speckled gray wings. Near a muddy water hole, she spotted a pair of animals that looked like large, striped greyhounds with long tails. "What are those?" Kendra asked, pointing.

"Thylacines," Camira responded. "Tasmanian tigers. We have many of them here. They're extinct elsewhere. Some have the power of speech. Look up that slope, by those bushes."

Kendra followed Camira's gaze and saw a hairy humanoid figure. As Elise shaded her eyes, squinting up-slope, the creature withdrew from sight.

"What was that?" Elise exclaimed.

"A Yowie," Camira said. "Kind of like a Sasquatch. They're timid, but curious. Elusive creatures. You often glimpse them, but they'll flee if you show too much interest."

"It seemed sad," Mara observed.

"Their songs are mostly forlorn," Camira agreed.

As the jeep neared the top of a gradual rise, the main house of Obsidian Waste came into view off to the left. Occupying high ground, the wooden house had numerous steep gables and a generous porch. An enormous barn was visible behind the house, along with a wide stable connected to a corral.

Ahead and off to the right, the river Kendra had noticed from the plane could now be seen, and behind it loomed the geometric form of the giant obsidian block.
(4958)

"I don't recall a river in the area on the maps I studied," Elise noted.

"The Rainbow River runs mostly underground," Camira replied. "But it surfaces here at Obsidian Waste, a gift from the Rainbow Serpent."

"Rainbow Serpent?" Kendra asked.

"One of our most revered benefactors," Camira explained. "An entity of tremendous creative power."

The engine revved, and the jeep raced across the distance to the house before sliding to a stop. The jeep with the boys had almost caught up, and it swung in to park beside them. Kendra jumped down to the ground.

"Seth says he's hearing voices," Trask said.

"Like dead voices?" Kendra asked. With help from the demon Graulas, Seth had become a shadow charmer, which, among other things, enabled him to hear the minds of the undead.

"Exactly," Seth said, brow furrowed. "It's weird. They're not talking to me, not directly, but I can hear them murmuring, thirsting. At first the voices were distant. Now they seem to be all around us."

"Do you have zombies buried around here?" ... (5157)

Task Card: Morse Code

Morse Code History

In 1836, Samuel Morse demonstrated the ability of a telegraph system to transmit information over wires. The information was sent as a series of electrical signals. Short signals are referred to as dits (represented as dots). Long signals are referred to as dahs (represented as dashes). With the advent of radio communications, an international version of Morse code became widely used.

The most well-known usage of Morse code is for sending the distress signal: **SOS**. The SOS signal is sent as:

••• - - - •••
S O S

SOS does not mean "Save our Ship" or "Save our Souls," it is just easily recognizable on a message.

Morse code relies on precise intervals of time between dits and dahs, between letters, and between words. Here's a chart that shows these relationships:

dit •

1 unit of time

dah -

3 units of time

pause between letters

3 units of time

pause between words

7 units of time

International Morse Code

1. The length of a dot is one unit.
2. A dash is three units.
3. The space between parts of the same letter is one unit.
4. The space between letters is three units.
5. The space between words is seven units.

A	••• -	U	••• -
B	••• -•••	V	••• -•••
C	••• - -•••	W	••• -•••
D	••• -•••	X	••• -•••
E	•••	Y	••• -•••
F	••• •••	Z	••• -•••
G	••• -•••		
H	••• •••		
I	•••		
J	••• -•••		
K	••• •••		
L	••• •••		
M	••• -•••		
N	••• -•••		
O	••• - -•••		
P	••• -•••		
Q	••• -•••		
R	••• •••		
S	•••		
T	•••		
		1	••• -•••
		2	••• -•••
		3	••• -•••
		4	••• -•••
		5	••• -•••
		6	••• -•••
		7	••• -•••
		8	••• -•••
		9	••• -•••
		0	••• -•••

The speed of transmitting Morse code is measured in WPM ([words per minute](#)). The word "Paris" is used as the standard length of a word. To transmit the word "Paris" requires 50 units of time. If you transmitted the word "Paris" 5 times, you would be transmitting at 5 WPM. An experienced Morse code operator can transmit and receive information at 20-30 WPM.

Samuel Morse

Samuel Finley Breese Morse, (1791-1872), was a famous American inventor and painter. Morse graduated from Yale in 1810 and went on to study painting in England. In 1815, he took up portrait painting and was quite successful in this field. Morse helped to found the National Academy of Design and served as its first president.

In 1827, Morse became interested in electricity. In 1832, he began a 12-year period perfecting his version of an electric telegraph, for which he subsequently received the first patent for this type of device.



Samuel F. B. Morse (1791 - 1872)

In 1844, Morse demonstrated to Congress the practicality of the telegraph by transmitting the famous message "What hath God wrought" over a wire from Washington to Baltimore. He later experimented with submarine cable telegraphy.



**Samuel Morse Telegraph Receiver
Used to receive the message, "What hath God wrought"
during the demonstration to Congress in 1844.**

Smithsonian National Museum of American History

Electric Telegraph

The telegraph was the first device to send messages using electricity. Telegraph messages were sent by tapping out a special code for each letter of the message with a telegraph key. The telegraph changed the dots and dashes of this code into electrical impulses and transmitted them over telegraph wires. A telegraph receiver on the other end of the wire converted the electrical impulses to dots and dashes on a paper tape. Later, this code became universal and is now known as **Morse Code**.



Telegraph Key Set

Before electric telegraphy, most messages that traveled long distances were entrusted to messengers who memorized them or carried them in writing. These messages could be delivered no faster than the fastest horse. In the United States, the Morse telegraph was successful for a number of reasons, including its simple operation and its relatively low cost. By 1851, the country had over 50 telegraph companies though most telegraph business was controlled by the Magnetic Telegraph Company, which held the Morse patents.

Your Tasks:

- 1) Encode a personal message in morse code on a blank sheet of paper. Make sure it is neat and easy to read. **Use: / between letters and // between words**
- 2) Decode the following message on the same sheet of paper.

/ between letters // between words

1) ●---●/●/---/●---●/● - ●●/●//●●●/-/●●/●-●●/●-●●//●●-/●●●/
●//--/---/●-●/●//--●●/---/-●●/●//-/---/-●●/●-/●--

- 3) See 'Telegraph Machine' folder for more fun with morse code.

Task Card: Columnar Transposition Cipher

1. Choose a 5 letter word that does not repeat a letter. An example would be 'house'.

2. Write this word down nice and big. Now number the letters the order they appear in the alphabet.

2	3	5	4	1
H	O	U	S	E

3. Next, start writing a short message out underneath without spaces or punctuation. (A)

A	2	3	5	4	1
	H	O	U	S	E
	h	e	l	l	o
	m	y	n	a	m
	e	i	s	a	s
	e	c	r	e	t
	c	a	n	y	o
	u	g	u	e	s
	s	w	h	o	i
	a	m	h	m	m

B	1	2	3	4	5
	E	H	O	S	U
	o	h	e	l	l
	m	m	y	a	n
	s	e	i	a	s
	t	e	c	e	r
	o	c	a	y	n
	s	u	g	e	u
	i	s	w	o	h
	m	a	m	m	h

4. Do you see the message? It says, "hello my name is a secret can you guess who i am hmmm"

5. The next step is to rewrite the columns in order (B)

6. Write the code out left to right:

ohellmmyanseiastecerocaynsugeuiswohmammh

8. The message is now encoded.

The idea behind a transposition cipher is to create a permutation (rearrangement) of the letters of the plaintext that will make the ciphertext appear to be well-encrypted. Transposition ciphers are not highly secure because they do not change the letters in the plaintext or even cover up frequencies, but they can be built upon to make more secure methods of encryption.

Task Card: Columnar Transposition Cipher

This was one of the most secure hand ciphers used in the Second World War. It was used by both the Allies and the Axis, and served both well. Its main weakness was that if the attacker intercepted two or more messages of the same length using the same key, they could be compared by a tedious process known as "multiple anagramming," finding solutions to both. This weakness was not important if only one message was sent using each key. It had an additional problem: Executing it correctly requires considerable care, leading to difficulties in decryption if an error is made at a sensitive point. In the United States, information about cryptanalysis of the cipher remained classified until a few years ago.

Double Transposition consists of two applications of columnar transposition to a message. The two applications may use the same key for each of the two steps, or they may use different keys.

Your Task:

- 1) Encode (write your own coded message using Columnar Transposition) on a blank sheet of paper. You need to show the original columns, the column in order, and the written out cipher. You can check your code to see if it works at <http://tholman.com/other/transposition/>
- 2) Decode this message with the key "flows" You know that it is a 5 column key because "flows" has five letters. Do this decoding on the same paper at #1.
1) **teaagthmocbeeyphyrnsonayeiriwb**
- 3) Go to <http://tholman.com/other/transposition/> and type in this cipher with the key of "pickle" and see what you get. Write your answer on the same paper.
1) **asurbomsadrenyvlolcsmleeteninenoadpsthaocts p i**
- 4) Create a double transposition message. Show the original column and key, the second column scrambled with a new key, and then the third final column. Write out the cipher. Use <http://tholman.com/other/transposition/> to type in your first scramble and then using the second key see if you can get back to your original message.

Task Card: History of the Cipher...and some.

- 1) Read pg. 7 and 8 of Codes, Ciphers, and Secret Writing by Martin Gardner and answer the following question on a blank sheet of paper.
 - 1) Would you like to be a cryptanalyst? Why or why not? Use examples from the text to justify your choice.
 - 2) How did code breaking actually cause the U.S. to enter into a war?

- 2) Read all of Spy Codes and Ciphers by Susan K. Mitchell and answer the following questions on the same paper as above
 - 1) How is cryptography used different now than in the past?
 - 2) List three interesting facts about the enigma machine that you learned

- 3) Go to <http://violetsvegnecomics.com/vegan-graphic-novel-for-kids-rebel-gang-and-the-number-ciphers/>, read the story, and answer the following questions on the same sheet of paper as #1 and #2.
 - 1) Simply write 3-5 sentences telling what you thought about The Rebel Gang and the Number Ciphers.