

A Dark of Endless Days

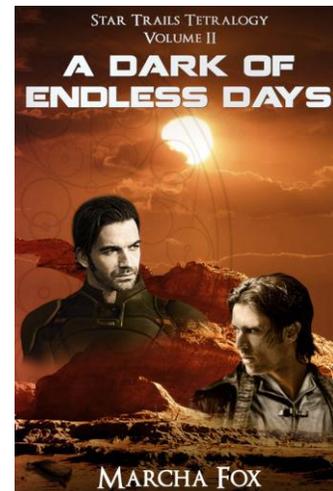
~~Ideas for Lesson Plans & Discussion Topics~~

Star Trails contains various lessons which are likely to be missed by casual readers. If used as part of a learning module those lessons can be pointed out and used as discussion points. Everyone makes mistakes, even adults, and it is much more effective to learn vicariously from those made by others, particularly fictitious characters, than make the same mistake yourself. This is also an opportunity to explore the science aspects in greater detail as part of science class curriculum or even explore the world of metaphysics. What follows is a summary of potential lessons contained in various chapters with suggested discussion topics that can prompt assignment ideas.

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Volume II: A Dark of Endless Days

- **Family dynamics: Parents make mistakes, too.**
- **Effects of orbital inclination on weather temperatures and patterns; planets other than Earth will be vastly different.**
- **Principles of self-sufficiency including water distillation and useful native plants.**
- **Engineering principles, e.g. how a heat exchanger (air conditioner) works using phase changes of the working fluid.**
- **Necessity of good planning coupled with back-up contingency plans.**
- **Consequences of using out-of-spec components and parts.**
- **Civil disobedience as it applies to political and personal freedom.**
- **Benefits of teamwork, structure and goal setting.**
- **Occam's Razor, i.e. the simplest solution is usually the best.**



Chapter 1 (*The Mother of Invention*)

1. The title of this chapter derives from the expression "Necessity is the mother of invention." What are the true necessities of life? What are some of the challenges in attaining them? How do these challenges change based on location, weather and equipment available?
2. Indigenous people and primitive societies have lived everywhere from the Artic Circle to the equator for thousands of years. How do you think they coped with their respective environments? Think about how they survived and with what, then take your list of necessities

and divide it into necessities needed to sustain life, essentials that are important such as electrical power, and luxuries which you could probably live without, even if you didn't want to.

3. If you could, how would you change the weather where you live? How would that change impact the environment including plant and animal life as well as for humans?

4. Have you ever been in a situation where you didn't agree with what was being done yet found it difficult, if not impossible, to leave? Why?

5. What are some *legal* alternatives for getting something you need if you need something but don't have any money?

6. Most major projects encounter problems that require some sort of change. What do you do when you find yourself in that situation? Can you adapt easily and find creative solutions? Or do you get angry and give up? Which approach is most effective?

7. Why did the still remove the sediment from the water? (When the water evaporated it left the sediment behind then condensed again as clear liquid.)

8. Have you ever wanted or needed something badly enough that you tried to make or build it yourself?

9. Creative problem solving is when you solve a problem in a different way by using your imagination and creativity to find the solution. Choose one of the challenges in your life and propose a creative way to solve it.

Chapter 2 (*Wildlife*)

1. What resources are available in your local area that would come in handy if you were a pioneer and first settler in the area?

2. Why do most areas of the Earth experience different seasons? (The tilt of the Earth's axis, which always points in the same direction like a gyroscope. When it is pointing toward the Sun, the Northern Hemisphere experiences warm weather and the Southern has winter. When it's pointing away, the opposite is true.)

3. Why does the Sun appear to move across the sky? (The rotation of the Earth. The Sun doesn't move, at least from the viewpoint of our solar system.)

4. Why does the Sun's position change with the seasons? (Unless you live on the Equator where the change is minimal, the Sun will be higher in the sky in summer and lower in winter. When it is higher in the sky its path across the sky is longer and thus you have longer days with the reverse true in winter. The angle striking the ground is different as well. When the Sun is high in the sky it will feel hotter than when it is lower. Thus, in the summer the Sun is high and hot plus it's up longer while in winter the Sun is low and cooler in addition to being up for a shorter time, resulting in cooler temperatures. The Sun will rise and set in a different place depending on the season. On the equinox (approximately March 22 and September 23) the Sun

rises in true East and sets in true West with night and day of equal length. The longest day of the year, known as the Summer Solstice, is usually right around June 21, with the shortest day or Winter Solstice, right around December 22. The Sun will always be in the same position for those events which many ancient civilizations knew and lined up their pyramids and various other structures so that they would line up with the Sun on one of those days.)

5. What should you always do before exploring wild areas? (Find out what hazards are in the area such a wild animals or poisonous plants. It is usually best to go with an experienced guide.)

6. What is one way to store energy? (A method everyone uses in one way or another is the battery. There are several different kinds, most of which depend on chemical reactions to release their power, such as those used in toys and flashlights. Larger batteries are used in automobiles which also depend on chemical reactions but are recharged by the car's alternator where mechanical energy is converted to electrical. In the case of solar power, the light from the Sun is converted to electrical energy and likewise stored in batteries for later use. According to the principle known as the conservation of energy, energy cannot be created or lost, only converted to a different form. One of the mysteries scientists are working on today involves Dark Energy which occupies the Universe. Albert Einstein's famous equation $E = mc^2$ tells us that matter is a form of energy [Energy = mass x speed of light squared]. This principle relates to the development of the atomic and hydrogen bombs as well as nuclear power which release the energy stored in matter. Matter, in turn, condenses from energy.)

Chapter 3 (*Confessions and Concessions*)

1. What "secrets" do you have that you've never shared with your parents? Why? Does anyone else know? Could they use that information against you in some way? If someone were to observe your every move day after day what could they learn and possibly use against you?

2. Who would you go to if you needed help with something important? Why? What have you learned that you could share with someone younger or less experienced that would make their life easier?

3. Why do items cost what they do? What is the concept of "supply and demand?" (The price of anything depends on several factors including the cost of materials, paying those who produce the item, expenses such as the equipment needed, and transporting it to the customers. This last expense is one of the reasons prices always go up with the price of gasoline. These are the costs related to what is known as the wholesale price or what a store or distributor will pay plus a certain markup so the producer makes a profit. The store or retail outlet will also add a certain amount to the price so they, also, make a profit. There is a saying about setting the price on something at "what the market will bear." This refers to how much customers are willing to pay for the item. If it's too low the seller could be making more money and may run out of the item. If it's too high, then no one will buy it and it will not make them any money at all or even indirectly cost them money if it is taking up space in their store where something more profitable could be placed. "Supply and demand" refers to having enough product available for everyone who wants to buy it. If something is in short supply then the price usually goes up. If

there is too much then vendors will compete for customers and the price can go down. It will also usually go down if no one wants it.)

Chapter 4 (*HE/927-652-A*)

1. What are the risks of going somewhere you've never been before, such as a foreign country, without learning something about it? (There may be laws you're not aware of that you could break and get into trouble. If they speak a different language you may not be able to communicate with others. They may use a different type of money in denominations that are unfamiliar. Simple gestures you use all the time that don't mean anything bad could be rude or obscene in another country and cause a fight or even get you arrested. The food may be extremely strange and consist of things you don't want to eat. The temperature there could be very different and require different clothing than what you usually wear. Sanitary conditions could be very different. There may be diseases there that do not exist in your native country which you could catch and become ill or even die. Transportation could be limited, expensive or nonexistent other than animals.)

2. If you don't understand what's going on is it best to proceed or rethink your situation? Why?

3. What are some of the Earth's energy resources? (As noted earlier, energy can be converted from one form to another. One example is hydroelectric power where the force of running water is used to turn turbines which in turn generate electricity. The water, in turn, obtains its power from gravity which results from the mass of the Earth. The Earth also has a massive magnetic field which results from the rotation of the planet's molten iron core. The Earth's magnetic field protects it from harsh radiation from the Sun and space itself by diverting it away. As yet science has not found a way to utilize this massive source of energy. Fossil fuel is another form of energy storage which is used to make gasoline and other petroleum products.)

Chapter 5 & 6 (*Worlds Apart & Earthbound*)

1. If there's a conflict between what you think and what you feel which one do you choose? Why? Has that worked as expected in the past?

2. If you were Creena, who would you believe first, Thyron or Aggie? Why? Which do you trust more, logic or intuition?

3. Have you ever been treated unfairly? How did you react? Did it help or make the situation worse? Why?

Chapter 7 (*Probability*)

1. Have you ever had a friend who got you into trouble? Was it because it was wrong or because you simply didn't understand what you were getting into?

2. Why would anyone want to control your mind? (To convince you to do what they want rather than allowing you to make your own decisions.)

3. When you want or need something what is the first thing you do? If you can't afford to buy it then what?
4. Should you always be entirely honest, even if the information will make the other person sad or angry? Are there any exceptions?
5. What is probability? (The term derives from whether or not it is probable or likely something will occur. This depends on how many choices or options there are. If you flip a coin there are two possible outcomes, heads or tails. Thus, you have one chance out of two that the one you choose will come up, also known as a 50:50 chance where $50 + 50$ adds up to 100% chance one or the other will occur. They say that lotteries are a tax on people who are bad at math because the chances of winning are usually one in a million or worse. Someone will probably win but the chance that it will be you is very remote.)

Chapter 8 (Debits and Credits)

1. Is all truth logical? Is it possible to know something without knowing how or why it is true?
2. What's the connection between science and engineering? How are they different? (Science studies nature and how it works. Biology is the study of life; geology is the study of the Earth; astronomy is the study of the stars and planets, and so forth. Scientists discover the secrets of these different subjects so we can understand the world around us. They develop theories and then set out to prove them, sometimes in the laboratory and sometimes through mathematical models. Engineers take the information scientists provide and apply it to inventions that make life easier and more interesting. For example, Albert Einstein was a scientist whose theories were primarily math models, including one for the concept of lasers. It was several years before technology caught up to his ideas and was able to test them in the lab. Taking the knowledge provided by scientists and applying it to useful inventions and new technologies is the function of engineers.)
3. Have you ever lost something that was valuable and/or meant a lot to you, perhaps because it was stolen? How did you feel about it?
4. What causes a tornado to form? (A tornado forms from pressure differences related to temperature which are further fueled by the Earth's rotation which causes the air to rotate. A condition known as wind shear which relates to strong downdrafts is also a major factor. When cool air from one area collides with warm, moist air from another the mixing effect can spawn violent thunderstorms and tornadoes. The central part of the United States is particularly prone to these violent storm and known as "Tornado Alley." The terrain is mostly flat, allowing the air to build up energy more easily than it would in a mountainous area which would break up the air flow. Tornadoes tend to form mostly in the spring and fall when temperature differences can be dramatic.)

Chapter 9 (The Lasomag)

1. If a law was passed you didn't agree with what would you do, especially if you felt you would be in danger as a result? (Such a situation is known as a moral dilemma, where there is

no easy answer and a downside to either choice. Reasoning can be sound for both, making the decision even more difficult with compromise seldom an option. Consequences associated with either choice are often harsh so careful consideration of all sides of the situation are required.)

2. Has something bad ever happened to you or someone you know because you didn't listen to someone's warnings? What did you learn from the experience?

3. What are superstitions? (Superstitions are usually beliefs that don't have a clear basis in scientific fact. Sometimes this only means that if there is any science involved it has not yet been discovered and proven. They are often based on myths or unusual experiences that don't have any logical explanation. In many cases they have a basis in truth but cannot be explained in a rational manner. Some are silly, such as the practice of throwing a few grains of spilled salt over your left shoulder to prevent bad luck. Others, particularly those that relate to nature including the weather, may be based on observations of phenomena that cannot be explained at the time but may be proven later.)

Chapter 10 (*Colonel Jenkins*)

1. Have you ever been in a situation where you didn't have the slightest clue what to do? How did you get through it? What would you do next time?

2. Is there any way you can really be prepared for anything? (Practice, training and procedures can be useful for known situations, particularly those that are dangerous in some way. Experience with emergency situations helps you prepare for future ones of a similar nature. However, there are some events which have never happened before so there is no experience or precedent to draw from. In some cases, such a situation was never considered before. It's important to consider what emergencies have in common and have a basic plan for any of them. Knowing what to do when something goes wrong is the primary focus of individuals who go into the career field known as Emergency Management.)

3. Who would you ask to help if you found yourself in a dangerous or difficult situation?

Chapters 11 - 13 (*Friends and Foes, Pursuit & Escape*)

1. What is photosynthesis? (Photosynthesis is the process by which plants use light to generate the energy they need to grow. It is the opposite from humans in that they use carbon dioxide as part of the process and turn it into oxygen whereas people use oxygen when they breathe and exhale carbon dioxide. Thus, people and plants have a synergistic relationship in which each one produces something the other needs to live. It is also sometimes referred to as the carbon cycle. Various manmade processes produce carbon dioxide that can upset this balance. It is known as a greenhouse gas because it tends to trap heat in the atmosphere and not allow it to escape into space. The planet, Venus, is a dramatic example of this effect with a thick atmosphere comprised largely of sulfuric acid (H_2SO_4) mixed with water and surface temperature of approximately 900 degrees. The greenhouse effect occurs when sunlight penetrates a planet's atmosphere as visible light then shifts wavelengths to infrared (heat) which cannot escape through the atmosphere to radiate off into space, thus continuing to heat the planet's surface.)

2. What is meant by the term "reverse engineering?" (In the simplest terms, this is the process of taking an object apart to figure out how and why it works, then trying to build another one. For example, if you took a watch apart you would see the components hidden within its case. If you could figure out what each one did you could conceivably use that information to create another one. However, if your knowledge of technology is not as advanced as the device you're taking apart you probably would not be able to figure out how and why it works and duplicate the process.)

3. What is "culture shock?" (Culture shock results when a person moves or visits somewhere that is entirely different than what is familiar to them. The behavior a person has learned, certain customs, traditions and even language including such things as slang and colloquial expressions are either ineffective or not understood in the new area, resulting in confusion and loss of security. Cultures operate on several levels and can comprise family or school traditions as well as that of a geographical area such as a city, state or country. When immersed in a new cultural environment a person can either cling to their old norms of behavior or attempt to assimilate all or part of the new ones. In either case, a certain period of discomfort is likely as the individual unlearns some elements of their background, such as an accent that identifies them with a certain area, and adjusts to the new. The level of resistance to change, acceptance of the new culture, and pressure from those in the new area all contribute to the process which can take years or in some cases, never be achieved with the person the proverbial "fish out of water." For example, picture an Eskimo from the Arctic suddenly moving to Mexico or vice versa. While their physical appearance may not be that different, everything else about their cultures would be from their traditional dress to food and shelter.)

Chapters 14 - 15 (*Aftermath & Serendipity*)

What is the best course of action when a person is overwhelmed and doesn't know what to do? (Find someone to talk to who will calm them down and help figure out what needs to be done in a logical sequence.)

Chapter 16 (*The Bensons*)

How many constellations can you identify? Do you know the myths associated with them? (The stars look as if they are all the same distance away, as if a giant bowl were inverted overhead. This view is known as the Celestial Sphere which has specific markers so that astronomers can identify the location of the stars, planets, asteroids and other celestial bodies. The stars are extremely far away and even though they may appear to be close together in the sky, they are usually not. Some lights that appear to be stars are actually other galaxies, with 100 billion stars in the Milky Way Galaxy and 100 billion galaxies in the known universe.

The other planets in our solar system look somewhat like stars except they move more quickly, thus being called "wanderers" by ancient civilizations who didn't understand what they were. Since the star patterns remain the same they are often referred to as the Fixed Stars. A band of twelve constellations known as the Zodiac surround the Earth along what is known as the ecliptic or apparent path of the Sun and form a backdrop for the planets. You cannot see all of them at once and will only be visible certain times of year. Consider that the Earth goes around the Sun and night occurs when your side of the Earth is facing away from the Sun. Thus, the

view of the night sky varies as the Earth orbits the Sun, always looking in a slightly different direction.)

Chapter 17 (*Cover-ups*)

1. What is one of Earth's most well-known satellite networks? What does it do? (The Global Positioning System or GPS, probably one of the most well-known satellite networks, provides you with position information. It is used for numerous applications from Facebook to locating stolen cars. There are 31 satellites, all in slightly different orbits at approximately 12,600 miles above the Earth. At least four satellites need to be above the horizon for a GPS receiver to calculate its location. This is done by computing the distance to each of the satellites based on the speed of light, *i.e.* the length of time it takes to receive each radio signal. These are then combined to determine the exact latitude, longitude and altitude. Other well-known satellites include the ones that deliver television programming, some internet providers and others used in telecommunications.)

2. What is an eclipse? (The two types of eclipses most often observed from Earth are solar and lunar. In a solar eclipse, the Moon passes between Earth and the Sun in a position where it blocks the Sun's light. In some cases it only blocks a portion of it, in others it may cover it completely or cover it with the exception of a ring of light which is called an annular eclipse. It's interesting that the Moon is the exact size needed to cover the Sun and thus cause a total eclipse. However, the Moon's orbit is elliptical and is not always at the same distance. If an eclipse occurs when the Moon is farther away and thus smaller, it may not cover the Sun and thus result in an annular eclipse. Solar eclipses are only observable over a small region. A lunar eclipse occurs when the Earth is between the Sun and the Moon with the Moon passing through the Earth's shadow. They last much longer and are seen over a much larger area than a solar eclipse. There are usually at least two of each type of eclipse each year, sometimes more. They occur when the Sun and Moon are within a certain distance of the lunar nodes, which are where the Moon's orbit crosses the ecliptic or apparent path of the Sun. Ancient civilizations such as the Mayans studied eclipses and were able to predict them far into the future with amazing accuracy. Some cultures saw them as bad omens or indicators of something that would happen, often of an unfortunate nature.)

Chapter 18 (*The PLED*)

1. Have you ever been able to predict what someone would do? How did you do it? Do you think that you are predictable? (If you know a person very well you usually know how they'll respond to certain situations. However, everyone has free will which means they can decide for themselves how they'll react and may not always be consistent.)

2. What are the advantages and disadvantages of having information available about everything a person has ever done? (It makes it more difficult for people to maintain their privacy. On the positive side, if someone is dishonest it's easy to find out but conversely dishonest people can also access the information and use it for illegal purposes such as what happens with identify theft.)

Chapters 19 - 20 (*Chores & Hauling Hay*)

1. What is the purpose of chores? (Chores teach responsibility as well as various skills. They also contribute to a sense of teamwork and working together for a common goal when used within groups or families to get things done.)

2. How do different types of music affect you? Do you ever use it to create a mood such as cheer you up, induce relaxation or simple to have fun?
3. If you could create a planet what would it be like? What would you change about Earth if you could?

Chapter 21 (*Return of the Cannibal*)

How do you know when you can trust someone?

Chapters 22 - 23 (*Prepare and Beware & Beneath the Surface*)

1. Have you ever found something out you really didn't want to know? How did you handle it?
2. How does a heat exchanger or air conditioner work? (An air conditioner is based on the scientific principle that when a fluid changes phases [gas, liquid, or solid] there is a change in its energy state. Some processes require energy and others release it. In an air conditioner a working fluid absorbs heat energy which causes it to evaporate or change phases from liquid to gas. The gas is then delivered to the condenser where it is cooled, usually by a fan, which releases the heat and returns it to the liquid state, further assured by the compressor for working fluids that would be a gas at normal temperatures, then begins the cycle again. In other words, the heat is transferred from one location such as inside a house and delivered outside where it is released. Ice cools a drink in a similar manner. As it absorbs the heat in the liquid the ice melts, creating a phase change again as it goes from solid to liquid. Another everyday example is steam, which can induce a serious burn as it releases its energy and condenses to its liquid state.)
3. Have you ever worked long and hard on a project until it was finished? How did you feel when it was completed?

Chapters 24 - 25 (*Betrayed & Intrusions*)

1. Has anyone ever lied to you then you found out later that they didn't mean to hurt you? How did you react?
2. Have you ever been tempted to do something you knew was wrong even though there were numerous reasons to go ahead and do it? How did you decide what to do? What were the consequences?

Chapters 26 - 27 (*Beating the Heat & Opposition*)

1. Has someone ever gotten something you really wanted such that you got jealous? How did you feel toward that person?
2. How effective is revenge? Who does it hurt the most?
3. Have you ever blamed someone else for a situation rather than accept responsibility or just deal with it? Does blaming someone else change the situation or make it better?

Chapter 28 (*Departing*)

What is Creena's dilemma in this chapter? What are the pros and cons of her choices?

Chapter 29 (*Surviving*)

What is the best way to solve a big problem? (Prevent it from happening in the first place. If this can't be done, remaining as calm as possible and gathering what resources you have is best.)

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