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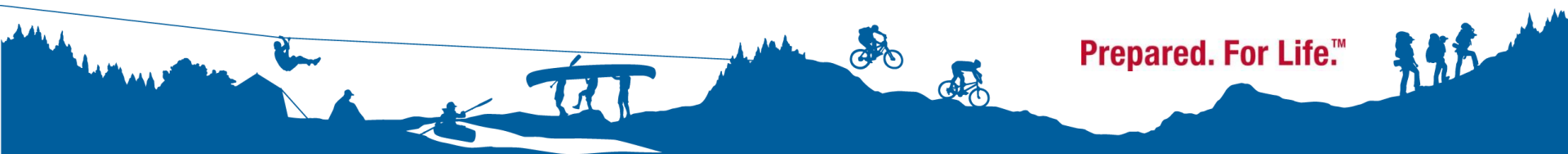
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Astronomy MB

Requirements 1-9

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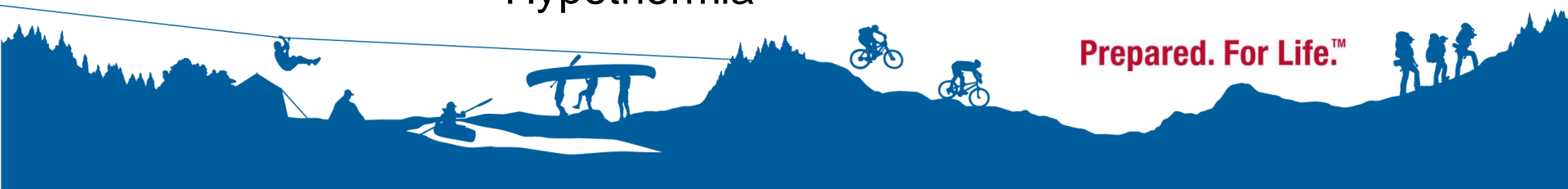
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Req. 1a – Explain to your counselor the most likely hazards you may encounter while participating in astronomy activities, and what you should do to anticipate, help prevent, mitigate and respond to these hazards.

HAZARDS

- Tripping and falling
- Heat or Cold
- Insects and Poisonous Plants
- Damage to your eyes
- Dehydration
- Heat Stroke/Exhaustion
- Hypothermia

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Req. 1a – Explain to your counselor the most likely hazards you may encounter while participating in astronomy activities, and what you should do to anticipate, help prevent, mitigate and respond to these hazards.

WHAT YOU SHOULD DO

- Visit your observation location during the day
- Look for poisonous plants
- Use a red-filtered flashlight
- Wear clothes that cover exposed skin
- Apply insect repellent
- Observe Mercury when the Sun is below the horizon
- Observe the Sun indirectly
- Keep properly hydrated
- Re-apply sunscreen
- Wear appropriate layers
- Eat plenty of energy foods

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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

HEAT REACTIONS

- Heat Exhaustion
 - Lie victim down in cool spot with feet elevated
 - Loosen clothing
 - Apply cool, damp cloths or use fan
 - Victim SIPS water

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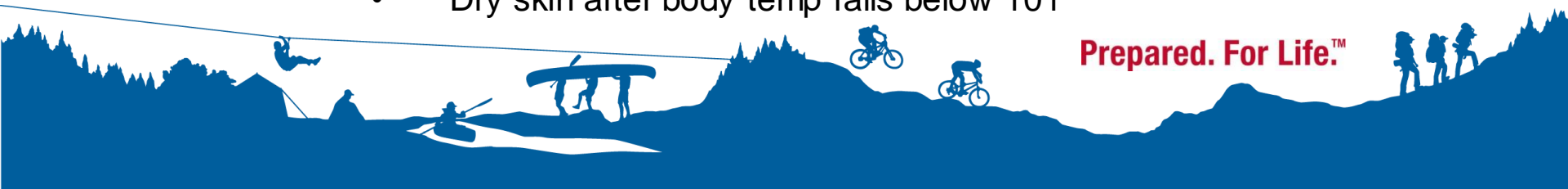
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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

HEAT REACTIONS

- Heat Stroke
 - Cool victim immediately!!!
 - Put victim in cool spot face up with head and shoulders raised
 - Remove outer clothing, sponge bare skin with cold water, soak under clothes with cold water
 - Apply cold packs, use fan
 - Put victim in tub of cold water
 - Dry skin after body temp falls below 101°

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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

HEAT REACTIONS

- Sunburn
 - Cool the skin w cool cloth or take a cool bath
 - Apply aloe vera lotion or something similar
 - Drink water
 - Take a pain reliever (ibuprofen)
 - Avoid more sun exposure
 - Apply over-the-counter hydrocortisone cream if sunburn is severe

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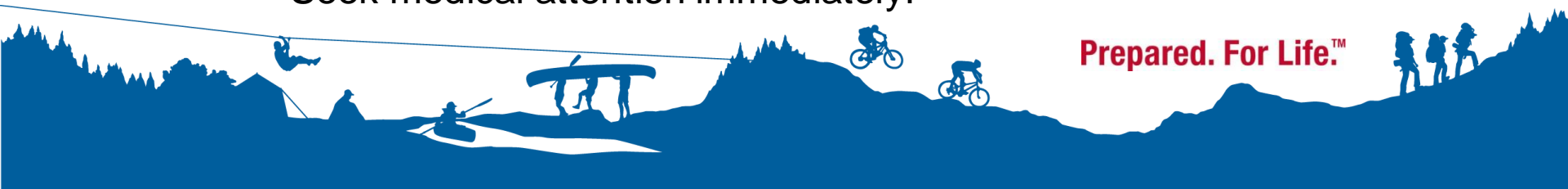
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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

COLD REACTIONS

- Move the victim to warm shelter
- Remove damp clothing
- Warm victim with blankets
- Cover head with warm hat
- Offer hot drinks
- If condition worsens, place in sleeping bag with 1 or 2 people, stripped of most clothing. Skin-to-skin contact can hasten the warming
- Seek medical attention immediately!

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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

Dehydration

- **HYDRATE!!!**

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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

BITES AND STINGS

- Apply a cloth dampened with cold water or filled with ice
- Apply 0.5 or 1 percent hydrocortisone cream, calamine lotion or baking soda paster to the bite or sting several times daily until your symptoms go away

A blue silhouette illustration at the bottom of the slide depicting various outdoor activities: a person rappelling, a person sitting on a log, a person in a canoe, a person carrying a canoe on their shoulders, a person on a bicycle, and a group of hikers.

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Req. 1b – Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.

DAMAGE TO EYES

- Avoid additional exposure to direct sunlight
- Quickly cool the eyes, i.e. with cloth damped with cool water
- See optometrist as soon as possible

A blue silhouette illustration at the bottom of the slide depicting various outdoor activities: a person rappelling down a rope, a person sitting on a log, a person in a canoe, a person carrying a canoe on their shoulders, two people on bicycles, and a group of hikers on a trail.

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Req. 1c – Describe the proper clothing and other precautions for safely making observations at night and in cold weather.

NIGHT

- Dress appropriately
- Wait 30 minutes for eyes to adjust to the darkness
- Use a red-filtered light to preserve night vision
- Wear shoes or boots with socks – NO SANDALS!

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Req. 1c – Describe the proper clothing and other precautions for safely making observations at night and in cold weather.

COLD

- Dress in layers
- Stay dry
- Eat energy foods

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Req. 1c – Then explain how to safely observe the Sun, objects near the Sun and the Moon.

- Observe indirectly by projection
- Proper filters
- Observe Mercury while the Sun is below the horizon
- Wait a couple of days before and after the New Moon, then look for a thin crescent in the evening sky just after sunset

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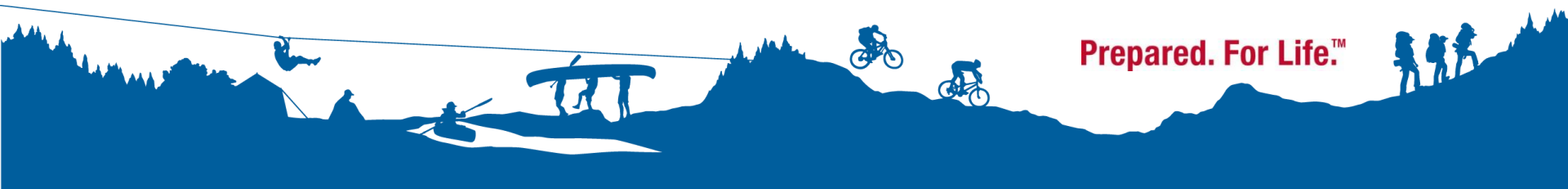
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Req. 2 - Explain what light pollution is and how it and air pollution affects astronomy.

- Too much artificial light concentrated in urban areas creating glowing domes over cities and towns
 - Street lights
 - Outdoor signs
 - Parking lot lights
 - Dusk-to-dawn security lights
 - Outdoor fixtures around private homes
- Turbulent air
- Clouds
- Low and high humidity
- Dust and chemicals

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Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:

a. Explain why binoculars and telescopes are important astronomical tools

- Objects are brighter and larger
- Binoculars
 - Allow you to use both eyes
 - Show objects right-side up
 - Are generally easier to transport and are less expensive
 - Easier to use than a telescope
 - Can be used to find objects for the telescope
- Telescopes
 - Work well in lower light due to larger apertures
 - Allow you to attach a camera to take pictures



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Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:

a. Demonstrate how these tools are used

- PRACTICAL DEMONSTRATION BY EACH SCOUT
- Telescopes are use by amateurs and professionals
- Professionals only observe a few months of the year
 - Processing the data of their observations
 - Not enough funding
- Amateurs back them up

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- Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:
- b. Describe the similarities and differences of several types of astronomical telescopes, including at least one that observes light beyond the visible part of the spectrum (i.e., radio, x-ray, ultraviolet or infrared)

RADIO TELESCOPE

- Pick up images astronomers would not be able to see otherwise
- A computer converts the signals into images
- Reveal details such as temperature and composition
- Much bigger than optical telescopes

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Arecibo Telescope



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Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:

- b. Describe the similarities and differences of several types of astronomical telescopes, including at least one that observes light beyond the visible part of the spectrum (i.e., radio, x-ray, ultraviolet or infrared)

X-RAY TELESCOPE

- Captures x-ray from very hot objects
- Must do so above Earth's atmosphere
 - It absorbs x-rays

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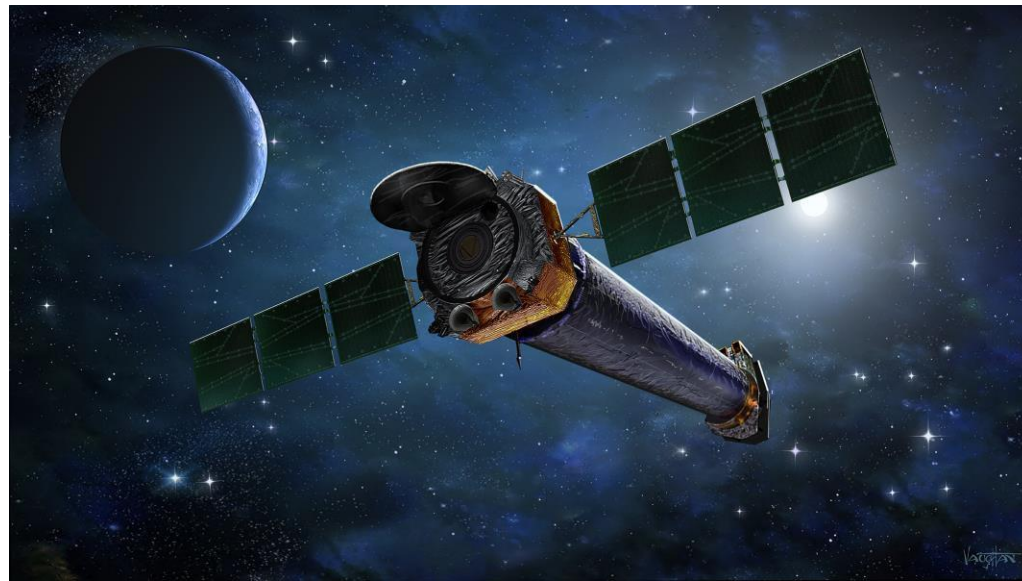




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Chandra X-Ray Telescope



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- Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:
- b. Describe the similarities and differences of several types of astronomical telescopes, including at least one that observes light beyond the visible part of the spectrum (i.e., radio, x-ray, ultraviolet or infrared)

ULTRAVIOLET TELESCOPE

- Detects light outside of visible spectrum
- Specifically light beyond the violet end of the spectrum

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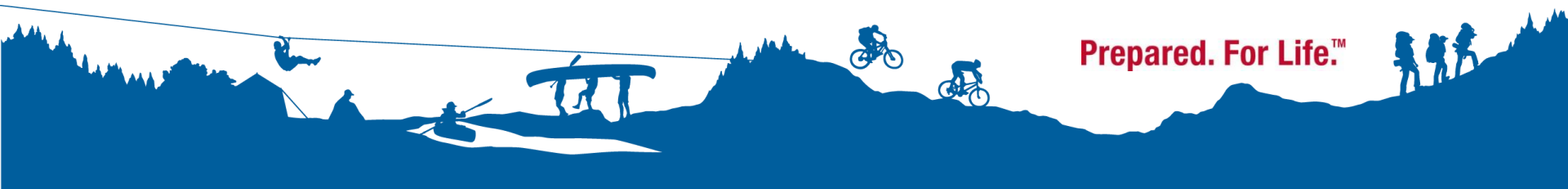
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Hubble Space Telescope



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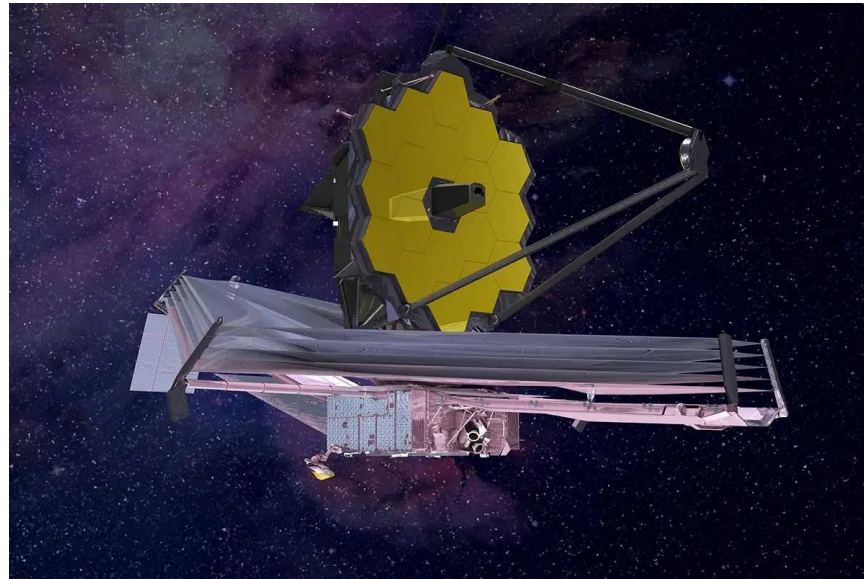




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James Webb Space Telescope



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- Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:
- b. Describe the similarities and differences of several types of astronomical telescopes, including at least one that observes light beyond the visible part of the spectrum (i.e., radio, x-ray, ultraviolet or infrared)

INFRARED TELESCOPE

- Detects light outside of visible spectrum
- Specifically light beyond the red end of the spectrum

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Spitzer Space Telescope



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- Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:
- c. Explain the purposes of at least three instruments used with astronomical telescopes.

SPECTROMETER

Separates light coming from an object in space into a detailed pattern of colored lines, much like a rainbow, called a spectrum.

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- Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:
- c. Explain the purposes of at least three instruments used with astronomical telescopes.

FILAR MICROMETER

- Mounted inside a telescope
- Measures the distance between double stars

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- Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:
- c. Explain the purposes of at least three instruments used with astronomical telescopes.

PHOTOMETER

- Measures the brightness or magnitude of light

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Req. 3 - With the aid of diagrams (or real telescopes if available), do the following:

d. Explain the proper care and storage of telescopes and binoculars both at home and in the field

- Follow manufacturer's directions
- Handle with respect, avoid bumping, dropping or shaking which can cause the lenses to crack or misalign
- Keep it all clean with special cloths and cleaners made for them
 - DO NOT SPRAY DIRECTLY ON THE INSTRUMENT
- Keep water away!
- USE THE BINOCULAR'S NECK STRAP!
- Store in a cool, dry place, avoiding extreme temperatures
- Use the storage case and/or rubber eye cups to protect the lenses

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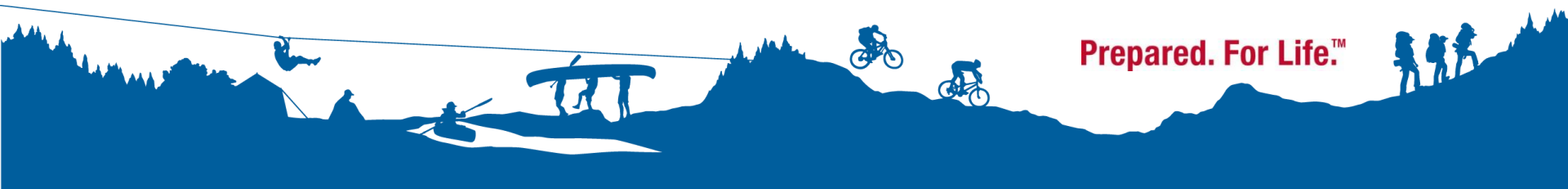
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Req. 4 – Do the following:.

- a. – Identify in the sky at least 10 constellations, four of which are in the Zodiac
- b. – Identify in the sky at least 8 conspicuous stars, 5 of which are a magnitude 1 or brighter
- c. – Make two sketches of the Big Dipper. In one sketch, show the Big Dipper's orientation in the early evening sky. In another sketch, show its position several hours later. In both sketches, show the North Star and the horizon. Record the date and time each sketch was made.

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Req. 4 – Do the following:
d. Explain what we see when we look at the Milky Way

- Our own galaxy
- The stars, star clusters, nebulae, the Sun, the Moon, the planets
- In the Northern Hemisphere, it's brighter in the summer in the constellations Aquilla and Cynus
- A disk of hundreds of billions of stars and vast quantities of dust and gas
- 100,000 light years across
- 10,000 light years thick

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Req. 5a – List the names of the five most visible planets. Explain which ones can appear in phases similar to lunar phases and which ones cannot, and explain why.

| Five Most Visible Planets | Phases? | Why? |
|---------------------------|---------|-------------------------------------|
| Mercury | Yes | Planet's orbit inside Earth's orbit |
| Venus | Yes | Planet's orbit inside Earth's orbit |
| Mars | No | Orbit is outside Earth's orbit |
| Jupiter | No | Orbit is outside Earth's orbit |
| Saturn | No | Orbit is outside Earth's orbit |



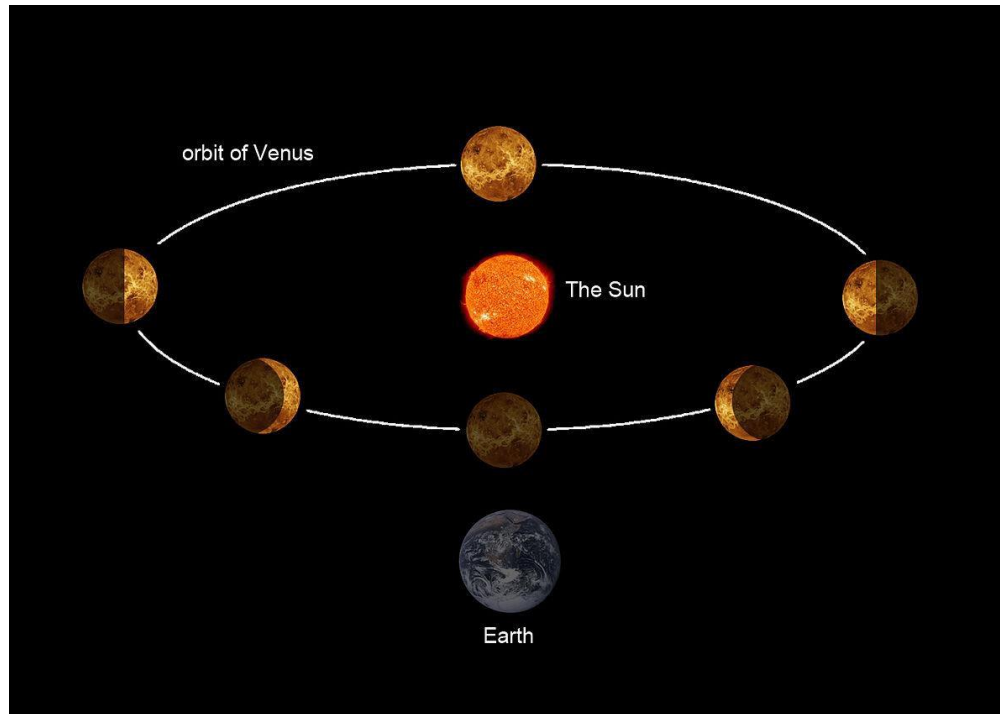
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Req. 5a – List the names of the five most visible planets. Explain which ones can appear in phases similar to lunar phases and which ones cannot, and explain why.



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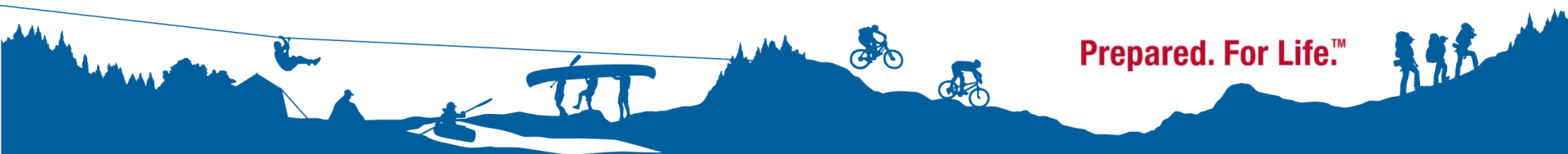
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Req. 5b – Using the Internet (with your parents' permission) by <https://www.nasa.gov/planets/other/visibility.html#2021> when each of the five most visible planets that you identified in requirement 5a will be observable in the evening sky during the next 12 months, then compile this information in the form of a chart or table.

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Req. 5b – Using the Internet (with your parents' permission), books and other resources, find out when each of the five most visible planets that you identified in requirement 5a will be observable in the evening sky during the next 12 months. Then compile this information in the form of a chart or table.

| Planet Name | Mercury | Venus | Mars | Jupiter | Saturn |
|----------------|---------|-------|------|---------|--------|
| January 2022 | Dusk | - | Mo | Mo | - |
| February 2022 | Dusk | Mor | Mor | Mor | - |
| March 2022 | Dusk | Mor | Mor | - | - |
| April 2022 | Dusk | Mor | Mo | - | - |
| May 2022 | Dusk | Mor | - | - | - |
| June 2022 | Dawn | Mo | - | - | - |
| July 2022 | - | - | - | - | - |
| August 2022 | Dus | - | - | - | - |
| September 2022 | - | - | - | - | - |
| October 2022 | - | - | - | - | - |
| November | - | - | - | - | - |
| December | - | - | - | - | - |

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Req. 5c – Describe the motion of the planets across the sky.

Each night, each planet's position seems to shift slightly eastward in relation to the stars. They seem to travel "through" the constellations over several weeks as they circle the Sun. The Inferior Planets show this the most easily. The Superior Planets move so slowly, it's much harder to see. Sometimes a planet shows a RETROGRADE motion, where it seems to move back toward the west before returning to an eastward drift. This is because the Earth has a faster, smaller orbit and appears to "catch" on outer planet.

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Req. 5d – Observe a planet and describe what you saw.

ANSWERS WILL VARY.

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Req. 6a – Sketch the face of the Moon and indicate at least five seas and five craters. Label these landmarks.



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Req. 6b – Sketch the phase and position of the Moon, at the same hour and place, for four nights within a one week period. Include landmarks on the horizon such as hills, trees, and buildings.

– Explain the changes you observe.

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Req. 6c – List the factors that keep the Moon in orbit around Earth.

- **Gravity**
Gravitational attraction exists between each pair of objects in space. So just as Earth's gravity tugs on the Moon, the Moon's gravity pulls on the Earth with an equal force. Gravity keeps the Moon "falling" around the Earth.
- **Inertia**
The tendency of an object in motion to continue in motion in a straight line.

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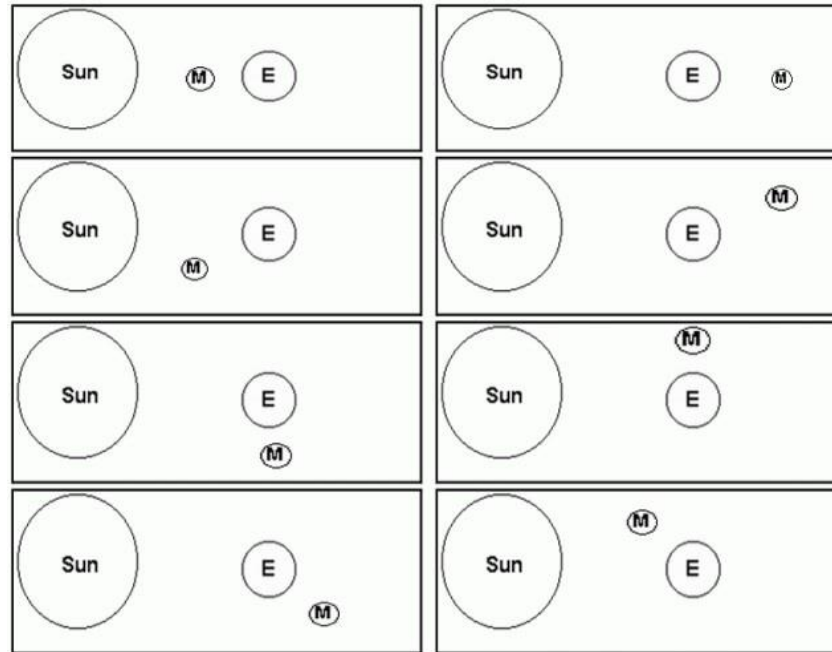


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Req. 6d – With the aid of diagrams, explain the relative positions of the Sun, Earth, and the Moon at the times of lunar and solar eclipses, and at the times of new, first-quarter, full, and last-quarter phases of the Moon.



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Req. 7a. Describe the composition of the Sun, its relationship to other stars, and some effects of its radiation on Earth's weather and communications.

Composition:

Mainly hydrogen and helium.

Relationship to other stars:

The Sun falls roughly in the middle of the temperature range of all stars. It is an average-sized star. It could live up to 10 billion years while other stars can live for 100 billion years.

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Req. 7a. – Describe the composition of the Sun, its relationship to other stars, and some effects of its radiation on Earth’s weather and communications.

Effects on Earth’s weather:

It burns off Earth’s moisture by evaporation, heats the atmosphere and creates wind when one air mass becomes hotter than another. Clouds condense from water vapor that has evaporated from the oceans and rain from these clouds returns water to the oceans.

Effects on communications.

Sunspots can cause static and drown out radio signals on Earth. If the energetic flow from the Sun is strong enough, it can cause power surges, damage sensitive electronics and overload power systems on Earth.



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Req. 7b. – Define sunspots and describe some of the effects they may have on solar radiation.

Definition:

Sunspots are "cooler" areas on the surface of the Sun, $\sim 7,000^{\circ}$. They appear in the photosphere as pairs or groups of dark spots that can measure 20,000 miles across. When there are many sunspots, the total energy coming from the Sun increases slightly. Sunspots are not permanent features of the Sun's surface. They come and go in cycles, usually over a period of 11 years.

Effects:

Sunspots can cause static electricity and drown out radio signals on Earth. If the energetic flow from the Sun is strong enough, it can cause power surges, damage sensitive electronics and overload power systems on Earth.

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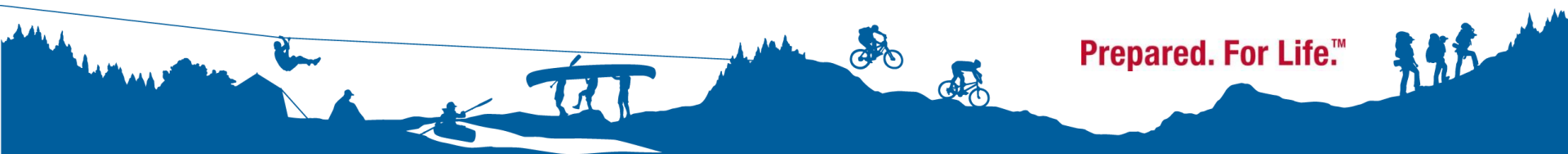
Req. 7c. – Identify at least one red star, one blue star,
and one yellow star (other than the Sun).

| | | |
|--------------|-----------------------|-----------------|
| Red star: | Betelgeuse (in Orion) | (Antares) |
| Blue star: | Rigel (in Orion) | (Altair, Deneb) |
| Yellow star: | Capella (in Auriga) | (Lambda, Zeta) |

Explain the meaning of these colors.

Red stars are the "coolest" - less than 6,000°. Blue stars are the hottest, 18,000-45,000°. Yellow stars are in between, 9,000-13,500°.

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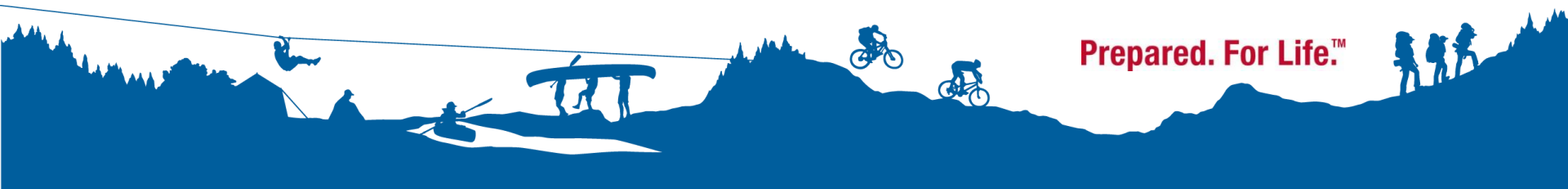
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Req. 8 – With your counselor’s approval and guidance, do ONE of the following:

- Visit a planetarium or astronomical observatory. Submit a written report, a scrapbook, or a video presentation afterward to your counselor that includes the following information:
 1. Activities occurring there
 2. Exhibits and displays you saw
 3. Telescopes and instruments being used
 4. Celestial objects you observed
- Plan and participate in a three-hour observation session that includes using binoculars or a telescope. List the celestial objects you want to observe, and find each on a star chart or in a guidebook. Prepare a log or notebook. Discuss with your counselor what you hope to observe prior to your observation session. Review your log or notebook with your counselor afterward.**

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Req 8 – With your counselor’s approval and guidance, do ONE of the following:

- Plan and host a star party for your Scout troop or other group such as your class at school. Use binoculars or a telescope to show and explain celestial objects to the group.
- Help an astronomy club in your community hold a star party that is open to the public.
- Personally take a series of photographs or digital images of the movement of the Moon, a planet, an asteroid or meteoroid, or a comet. In your visual display, label each image and include the date and time it was taken. Show all positions on a star chart or map. Show your display at school or at a troop meeting. Explain the changes you observed.

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Req. 9 – Find out about three career opportunities in astronomy. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor and explain why this profession might interest you.

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