Name: _____
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Using *Stellarium*

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The purpose of this exercise is to familiarize yourself with the *Stellarium* program and its many capabilities and features. *Stellarium* is a visually beautiful and powerful program that accurately displays the sky as seen from any place on Earth (or from any other planet!) at any time. It's easy to use, but also full of accurate astronomical information. If you have patience and follow the guidance in this and future assignments, by the end of the semester you will be experts at using this amazing program! You will want to keep and use *Stellarium* for years to come, as your personal planetarium and observatory! And the best thing about the program? It's free!

PART A

Our first step is to download and install the program. Go to our class web page and follow the link to the *Stellarium* web site, or go directly to the website: http://www.stellarium.org and download the correct version of the program, either the one for PC, Mac, or Linux, depending on what kind of computer you have. Once you have downloaded the appropriate file and saved it on your computer, run that file (double-click on it) to install *Stellarium* on your computer.

NOTE - This and all other exercises are written for version **0.18.2** of *Stellarium*. There might be small variations in the controls and display for other version of the program, but ALL VERSIONS SHOULD WORK! If you have a problem with one version of the program working, try downloading an earlier version until you get one that works.

PART B

Now let's start the program. Double-click on the *Stellarium* icon (it shows a small crescent Moon and some stars above a horizon) that should now be on your computer's desktop or in one of its menus.

You are looking at the sky and the Southern horizon, as they appear right now, from a field with trees on the horizon. Your location information is always listed in the **Information Bar** at the bottom of the screen. The program chooses its location from the computer's location.

You'll need to set the home location – this is the viewing location that the program will automatically use to display the sky every time it starts. For us, obviously, this will be Panama City, Panama (appears as Province of Panama, Panama). When you move your cursor to the lower left-hand corner of the screen, two **menu bars** appear - a horizontal one on the bottom of the screen and a vertical one on the lower-left side of the screen. Each of these menu bars display some icons. When you click on any of these icons, a corresponding window opens up to control a particular part of the program. On the **vertical** menu bar, click on the **Location Window** icon (it looks like a compass symbol). This will open the **Location** window. You can also simply press **F6** to open the **Location** window if you have a Windows PC.

In the **Location** window you will see a map of the Earth on the left and a list of locations on the right, below which is a **search box** (where the magnifying glass icon is) to enter a location. Type "Steamboat Springs" in the search box, and then click on the name when it appears. If Steamboat Springs is not in Stellarium's database of places, you'll have enter it manually. You can enter the **Latitude** and **Longitude** of your location directly into the program, with the controls below the map. The Latitude of Panama City is **8° 58' 60'' North**, and the Longitude is

79°, 31' 0" West. Don't worry about what these numbers mean – just type them in, along with an altitude of 0 **m**. Once you have set yourself to Panama City, you need to save it as the default location so that every time you start the program you will be observing the sky from there. To do this, make sure that the **Use Current Location as Default** box in the lower left-hand corner of the **Location** window has a check mark in it, and then close the **Location window** by clicking on the **X** in the upper right-hand corner of the window (Don't close the whole program!). From now on, when you start the program, you should be automatically observing the sky from Panama!

Stellarium can accurately show you exactly which stars, constellations, planets, nebulae, galaxies, asteroids, comets, and even satellites are in the sky at any time, give you information about them, and show you how they all change positions as time passes. It's a very exciting program, but it takes a bit of getting used to. If you ever need help within the program, click on the **Question Mark** button in the lower left edge (or press the **F1** key), to open the **Help** window.

You're now ready to start exploring *Stellarium*! First let's look around the screen. You are looking at a view of the sky, with the ground below it. You are facing **South** (see the red "**S**" on the ground at the center? – that means "South"), and you should be located in Panama City, indicated by "**Earth, Panama City, 0m**" in the **Information Ba**r at the bottom of the screen. The **0m** indicates that you are 0 meters above sea level. The time and date listed to the right in the **Information Bar** should match the local time (as long as your computer itself has the correct time!). **UTC -5:00** means that we here in Panama are currently 5 hours behind the world's official time in London (known as "UTC"). If you're doing this assignment during the day, the sky looks blue, as you would expect! If you're doing it at night, the sky looks dark, and there are stars (and perhaps planets and the Moon) visible, again, as you would expect!

Let's start navigating around the program. The buttons on the two menu bars have icons that represent various functions of the program, and each opens a window that allows you to change various parameters of the program. The most important button is the **Sky and Viewing Options Window** button, which has star and planet symbols on it. This button opens the **View** window, which has **five** sub-menus listed on tabs across the top.

Press the **Sky and Viewing Options** button to open the **View** menu. You can also open this menu by simply pressing the **F4** key on a Windows PC.

- What are the names of the seven **sub-menus** listed across the top of the **View** Window? _____

  _____

You can click on any of these sub-menus at the top and a different window will open up. Let's look at some of these sub-menus.

- What **Landscapes** are available in *Stellarium*? _____

  _____

- List five of the **Sky Cultures** that are named in the **Starlore** sub-menu. _____

  _____

- In which sub-menu do you find the **Twinkle** selection? _____

The **Sky, SSO and DSO** sub-menus of the **View** Window are important ones. The Sky sub-menu controls how the sky and stars are displayed on screen in *Stellarium*. Let's look at it. There are sections here for **Sky** and

S**tars**. In both sections some items have boxes or sliders next to them that can be moved or checked or unchecked with check marks.

- What items are checked in the **Stars** section? _____

  _____

- What is the "**Limit Magnitude**" set to in the **Stars** section?

  _____

- What is "**Shooting Star**s" rate set to? _____

In the **SSO** sub-menu, ("SSO" stands for "Solar System Objects") If they're not already checked, click on the boxes next to **Solar System Objects** and **Show Planet Markers** to put checks in those boxes. Close the **View** menu.

Now open the **Date and Time window** by clicking on its icon (a little clock) in the left-hand menu bar. By clicking on the arrows above or below each number in the **Date and Time** window, change the date and time to **January 1, 2006**, at **3:00** in the afternoon. (*Stellarium* uses "military time," where 1PM = 13:00, 2 PM = 14:00, etc.).

- What happens to the sky and the objects in the sky as the date and time change? _____

Close the **Date and Time** window by clicking on the "x" in its upper right-hand corner.

Press the **Page Down** button a few times (or **CTRL** and the **Down Arrow** key) on your computer as you watch the screen.

- What happens on screen? _____

- What happens when you press **Page Up** (or **CTRL** and **Up Arrow**)? _____

Keep **zooming** in or out until you see the setting Sun near the South Western horizon. There are two big bright dots near the setting Sun that are hard to see, just as they'd be hard to see if you went outside and looked at the setting Sun! Zoom out until you just see them. To see the objects more easily, simply press the **A** button your keyboard. This button is called the **Atmosphere** button.

What happens when you press the **A** key? _____

Click on the two big, bright dots near the Sun in turn and look in the upper left-hand corner of the screen, where the **information** about what you clicked on will appear.

- What are these two dots? _____

Now let's start changing some settings in the program. One of the nice features of *Stellarium* is a series of simple keyboard commands that perform shortcuts. For example, to instantly change *Stellarium* to display the sky at the **current time**, just pre8ss the **8** key. Try it! Now change the time and date back to **12 Noon** on today's date, using the **Date and Time** window. Use the "**A**" key to turn off the atmosphere on and off a few times. Leave the atmosphere off.

Now press the "**F"** button on your keyboard. This is the **Fog** button. You may have to press it several times to notice what happens. Look carefully near the horizon.

- What happens? _____

Now press the "**G"** button on your keyboard a few times. This is the **Ground** button.

- What happens? _____

Press the "**A," "G," and "F"** buttons again to turn the **Atmosphere**, **Ground** and **Fog** back on. These are very useful buttons! If you ever want to see what stars are out during the day, you can do it with *Stellarium* by simply pressing the "**A"** key! Note that you can also turn the **Ground**, and **Atmosphere** on and off using their icons in the toolbar at the bottom of the screen.

Suppose you wanted to look at a different part of the sky than the Southern horizon? No problem! There are many ways to "point" in a different direction. Perhaps the easiest one is to "grab" the sky and drag it. To do this, just click and hold the left mouse button down while dragging the mouse. As you do so, the sky is dragged. Try it.

Let go of the sky and drag it several times until you are looking at the **Northern** horizon. Now look at the **Eastern** & **Western** horizons.

Now let's zoom out to see the whole sky at once. Zoom out (by pressing the **Page Down** button) until the **Field of View** (indicated by **FOV** in the middle of the **Information Bar** at the bottom of the screen) is at least **180°**. Then drag the sky and/or horizon around until the whole sky is centered on the screen. Then drag the horizon around in a circle until **North** is at the top of the screen. You should now be looking at the whole sky at once, shown as a complete circle, centered on your screen, with the horizon (North, South, East and West) forming the edge of the circle. The point at the center of this circle of the sky, which corresponds to the spot outside directly over your head, is called the **zenith**. Note also that **East** and **West** are reversed, as discussed in class, since sky maps are meant to be held over your head.

How do you know what you're looking at in *Stellarium*? Let's put labels on things onscreen. Open the **View** window, and look in the **Sky** sub-menu. Look in the **Stars** section. If there isn't one already there, put a check mark next to the box that says **Stars**. When you close the window, the names of the brightest stars will appear. Remember, you may have to first press the **"A"** key to turn the atmosphere off and make the stars visible!

Pick any one of the bright stars and click on it carefully. When you do, it is selected, and a small "cross-hair" appears on the star. Information about that star appears in the upper left-hand corner of the screen. Much of this information will make no sense to you yet, but by the end of the class, it will all be clear! The first line of information contains several versions of the star's name, starting with the star's common name.

- What is your chosen star's common name? _____

Let's show the names of more stars. Re-open the **View** window, and again look in the **Stars** section of the **Sky** sub-menu. Put a check mark next to the **Labels and Markers** slider and drag the **slider** back and forth. **Close** the window.

- What happened? _____

Go back and drag the slider back to where it was.

Suppose you wanted to center something in the sky. No problem. Simply click on the object to select it, and then press the **space bar**. Pick another bright star and center it.

PART C

One of *Stellarium's* most important features is its ability to change, slow down, speed up or reverse **time** and watch how things move in the sky. *Stellarium* shows you the way the sky looks at any time, and it changes as the real sky changes!

To see this, center the **Eastern** horizon on the screen (by dragging the sky until the "**E**" is in the center of the screen), **zoom in** until the **Field of View** is about **10°** (you may have to drag and recenter the "**E**" as you zoom to keep it from drifting off screen), and set the **Date and Time** to **March 21, 2008**, at **6:50 AM**. Make sure the **Atmosphere** and **Fog** are turned off by using the "**A**" and "**F**" keys (or by using the toolbar at the bottom of the screen). Open the **View** window and make sure there are **checks** in the boxes next to **Stars** and **Planets** in the **Labels and Markers** section of the **Sky** sub-menu. Close the window and simply watch the sky. Keep watching for **10** minutes.

- What happens? _____
- What time does it happen? _____

Suppose you don't want to wait for things to happen in "real time." Suppose you want to make the time pass faster. No problem. Reset the time to **6:50 AM**, and this time look at the buttons at the **right** side of the **bottom tool bar**. These are the **time control** buttons. One looks like a triangle – like a "play" button. This is the **Set Normal Time Rate** button. To the right of this is one that looks like an hourglass. This is the **Set Time to Now** button that automatically sets the time to the current time. Press it. Did the time and date change? To the right of this button is the "Fast Forward" button – it's two triangles. This is the **Increase Time Speed** button. Finally, the farthest button to the left is the **Decrease Time Speed** button.

Each of these buttons has a keyboard shortcut – pressing the **K** key is the same as pressing the **Set Normal Time Rate** button, pressing the **8** key is the same as pressing the **Set Time to Now** button, pressing the **L** key is the same as pressing the **Increase Time Speed** button, and pressing the **J** key is the same as pressing the **Decrease Time Speed** button.

Reset the time and Date back to **March 21, 2008**, at **6:50 AM**. Press the **Increase Time Speed** button once (or simply press the "**L"** key on your keyboard). Watch the sky and look at the time in the **Information Bar**

- What do you notice about the way time is passing? _____

Press the **Normal Time Rate** button (or the **K** key) and reset the **Date & Time** again to **March 21, 2008**, at **6:50 AM**. Now press the **Increase Time Speed** button in the Time Control Bar **twice** and watch the sky and the Sun.

- What happens to objects in the sky? _____
- What happens if you press the **Increase Time Speed** button three times? _____
- What happens if you press the **Increase Time Speed** button four times? _____

Press the **Set Normal Time Rate** button (or press the **K** key) to return to normal time. Now press the **Decrease Time Speed** button (or press the **J** key).

- What happens to objects in the sky? _____

- What happens if you press the **Decrease Time Speed** button twice times? _____

- What happens if you press the **Decrease Time Speed** button three times? _____

Each time you press the **Increase Time Speed** or **Decrease Time Speed** button, the time speed is changed by a factor of **10 times** slower or faster.

We can also **step** time forward in discrete units. For example, we can make time go forward by one hour or one day in one single jump. Let's do this. Press the **Set Time to Now** button (or press the **8** key) and the **Set Normal Time Rate** button (or the **K** key) to make time go normally. Look at the **Information Bar** to see what day and time it is. Now press the **CTRL** and "=" (equals) keys on your keyboard and look at the **Date & Time** in the **Information Bar** again.

- What happened to the date and time? _____

Now press **CTRL** and "-" (minus) keys on your keyboard and then look at the **Date & Time**.

- What happened to the date and time? _____

Now press the "**-**" key on your keyboard, and then the **"**=**"** key as you look at the **Date & Time**.

- What do the "-" and "=" keys do to time? _____

- What do the "[" and "]" keys do to time? _____

Stellarium allows us to change time backwards and forwards as much as we want, and make it go faster and slower any way we want!

PART D

Stellarium can also show you a lot more than just stars. For example, we can see which planets are in the sky right now. First, change time back to now by clicking on the **Set Time to Now** button (or by pressing the **8** key). Then **zoom out** and reenter until the whole sky is visible. To have *Stellarium* point the planets out, open the **View** window, go to the **SSO** sub-menu, and check the boxes next to **Solar System Objects** and **Show Planet Markers**. Close the window. The planets (and perhaps a few of the larger asteroids) should be labeled on screen, with circles around them to distinguish them from stars. You can also display the Planet Labels by clicking on the **Planets Labels** icon in the bottom toolbar, or simply press the **P** key on your keyboard – try pressing it a few times!

Pick one of the planets that you see on the screen now, and click on it. To center the planet on the screen, press the **space bar**.

- Which planet did you choose? _____

If you're answering this question during the day, turn off the atmosphere by pressing **A**. Find the nearest bright star to your planet. Click on that star to identify it.

- What bright star is your planet near? _____

Click on your planet again to select it. Now let time pass as fast as you want, until you see the planet **set** on the horizon. NOTE: since you have selected and centered the planet, it will stay still in the center of the screen, and the ground will rise up to meet it – that's okay – just imagine that you are keeping your eyes on the planet as it moves

toward the ground! Now go backwards in time until you see the planet **rise**. You may have to make time go forward or backward, or speed it up or slow it down, until your planet is just on the horizon.

- What time does this planet **rise** today? _____ What time does it **set**? _____

Stellarium also has a useful function that allows you to find any object in the sky. To use it, click on the Search Window icon (the little magnifying glass) in the left-hand menu bar (or simply type **CTRL-F** or press the **F3** key) to open the **Search Window**. Once the **Search Window** is open, simply type in the name of the object you're looking for in the box, and hit **Enter**. *Stellarium* will select that object, center it on the screen, and display its information in the upper left-hand corner. If the object is not in the sky at the moment, *Stellarium* will point at the ground, since that's where you would have to look to see it! To see the object in this case, you have to make the ground disappear. Do this by pressing the "**G**" key on your keyboard.

Find the planet **Jupiter**. **Zoom** in to it until you can see the planet as a disk. An easy way to do this is by simply pressing the **"/"** ("slash") key. Do you see the four labeled dots to one side or another of Jupiter (their names are **Io**, **Europa**, **Ganymede** and **Callisto**)?

- What do you think these objects are? _____

Let's look at one of the so-called "**Deep Sky**" objects. We'll find out later in the semester what this term means, but for now, let's just say they're exciting, far-away objects in the sky. Use the **Search Window** to find **M31**. M31 is also known as the Andromeda Galaxy! **Zoom** in or out until the Andromeda Galaxy fills the screen!

- Describe the Andromeda Galaxy _____

  _____

The "M" in M31 stands for Charles Messier, a famous astronomer from the 18th century. Try picking another "M" object by typing in another number (1-103) after **M** in the Search window. Zoom in to see your new Messier object up close.

- Which object did you choose? _____
- Describe your object _____

  _____

Finally, close *Stellarium* by clicking on the **Quit** button at the right of the toolbar at the bottom of the screen.

Whew! As you can see, *Stellarium* is a beautiful, powerful and complex program. We will make good use of it this semester, however it will take some getting used to! Don't worry! Soon you will have mastered it.

Write a few sentence-long conclusion describing what you learned in this exercise, what you like about the *Stellarium* program and what you *dislike*.

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Observing the Sky

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All Astronomy begins with looking at the sky. For thousands of years humans have watched the sky at night, carefully noting the positions of the stars and planets, and how they change as the hours, days and months go by. Indeed, until modern times, knowing the sky was a matter of life and death! If a farmer misjudged when he or she should plant his or her crops, or if a nomadic hunter-gatherer misjudged when he and his family should start moving South for the Winter, the result was certain death! To make observations of the night sky easier over the millennia, people developed various names for both stars and groups of stars, which are called **constellations**.

In this assignment we'll use *Stellarium* to observe the sky tonight. We'll see what stars and constellations are visible, and try to understand how they move as the hours pass.

PART A

Start *Stellarium*. Make sure you are observing from Steamboat Springs (if you haven't already set Steamboat as your default home location) by opening the **Location** window (Find the **Location** icon at the left-hand side of the screen, or simply press the **F6** key), entering Panama City, Panama in the search bar, and then clicking on **Panama** Close the **Location** window. You can also enter the Latitude and Longitude of Steamboat into the program by hand. See the previous assignment for details.

Zoom out until the **Field of View** (indicated by **FOV** in the Information Bar at the bottom of the screen) is about **180°**. The easiest way to do this is by pressing **CTRL-ALT-1** on a Windows computer. Then drag the horizon around until the sky is centered on the screen (or press **SHIFT-Z**) and drag the horizon until **North** is at the top. You should see the sky as a complete circle, centered on your screen, with the horizon (North, South, East and West) forming the edge of the circle, and the **zenith** at the center.

Turn the atmosphere off (if it is on) by pressing "**A"**. You should see a sky full of stars (and perhaps some planets and asteroids). Set the time for **9 PM (21:00** in "military time") by clicking on the **Date/Time** icon on the left-hand side of the screen (or by simply pressing the **F5** key) and adjusting the time.

As you click on various dots in the sky (almost all of which are stars), a cross hair appears over your selected star, and information about the star appears in the upper left-hand corner of the screen. There's a lot of information here, including, on the first line, the various names of the star. The first name listed in that top line is the **common name** of the star. Let's start with those names. Find the three **brightest** stars in the sky (the three biggest dots) and click on them one at a time. If one of the brightest dots is a planet, pick another one!

- What are your three stars' common names? 1:_____ 2: _____ 3: _____

In each star's information listing, look for the line that says "Distance." This is the distance to the star in **light years** (as you remember from class, a **light year** is the distance light travels in one year).

- What are the distances to your three stars? 1:_____ 2: _____ 3: _____

You might recognize some of these stars. Each of these stars is part of a specific **constellation,** or area of the sky assigned to a particular mythical character, object or animal. To see the stick-figure outlines of the constellations, press the "**C"** key on your keyboard, or click on the **Constellation Lines** button in the toolbar at the bottom of the screen. Lines appear connecting the brightest stars in each constellation. To show the names of the

constellations, press the "**V"** key on your keyboard, or click on the **Constellation Labels** button in the toolbar at the bottom of the screen. Many of these constellation names should also be familiar.

- Name the three constellations that contain your three stars: 1:_____ 2: _____ 3: _____

As you can see, it's hard to tell where in the sky one constellation ends and the next one begins. To see the official borders between constellations, press the "**B"** key on your keyboard. The constellations' boundaries appear as red dashed lines. These borders are arbitrary, kind of like the borders between states – but astronomers have agreed to define them precisely, so that every spot in the sky (and hence every star) is in exactly one constellation. To see pictures of the mythical characters associated with each constellation, press the "**R"** key on your keyboard or click on the **Constellation Art** button in the toolbar at the bottom of the screen.

Change the time to **9 PM** on today's date (open the **Date/Time** window or press the **F5** key), then answer the following questions (It may be easier to see the constellations if you zoom in or out and drag the sky around to re-center it):

- What constellation is just above the Southern horizon at 9 PM tonight? _____
- What constellation is just above the Northern horizon at 9 PM tonight ? _____
- What constellation is at the Zenith at 9 PM tonight? _____
- How many constellations are in the sky at 9 PM tonight? (count them!) _____

Open the **Search** Window (type **CTRL-F** or press **F3**) to help you find the following objects. Remember, once you've typed the name of an object in the **Search** window, hit **Enter** and that object will be selected and centered on screen. If the object is hidden by the Earth, press the "**G**" to key to hide the ground.

- Find the constellation **Ursa Major**. Name two stars it contains. (Remember, click on a star to see its name.) _____
- Find the star **Rastaban**. What constellation is it in? _____

Find the star **Arcturus**. Look at the information that appears on screen about it.

- How far away is **Arcturus?** _____

Display the labels of the planets and the bright stars by pressing the **Planets Labels** button in the toolbar at the bottom of the screen (or by simply pressing **Alt-P** on a Windows computer). If you don't see any planets labeled on screen, open the **View** window and, in the **SSO** sub menu, make sure there are check marks next to the **Solar System Objects**, **Show Planet Markers** and **Labels and Markers** boxes. Close the **View** window. **Zoom back out** to see the whole sky. Make sure the constellations are displayed. If they aren't, press **C**, **V** and **B** until you see them, their names and their borders.

- Is the Moon out right now? _____ If so, what constellation is it in? _____

Set the time for **1 PM** on today's date. Again, make sure that you can see the whole sky by zooming out and dragging the sky around.

- Find the **Sun**. What Constellation is it in? _____

Now let's see what the sky looked like on **August 10, 2005**. Enter this date in the **Date/Time** window. Set the time for **9 PM**. Find the **Moon** in the sky and center it.

- What bright, named star is the Moon near? _____

- What constellation is this star in? _____

- What constellation is the moon in on August 11? _____

Remember, rather than re-entering the new date information each time, you can simply press the "=" key to advance the time by one day.

- What constellation is the Moon in on August 12? _____

- What about August 13? _____

- What about August 14? _____

Note that the Moon jumps around in the sky from night to night!

- What explanation can you come up with for this motion?

_____

As we saw in the previous assignment, there are many things to see in the sky besides stars, including planets, comets, asteroids, galaxies, nebulae, star clusters, and much more!… These last three objects are called **Deep Sky Objects**. Each of these is a distant object much bigger than a single star and permanently located at a certain spot in the sky, in a particular constellation. There are many catalogs of Deep Sky Objects, most of which were published in the 18th or 19th centuries, including the **NGC** catalog (the **New General Catalog**), the **M** catalog (named after French astronomer Charles Messier), and the **IC** catalog (the **Index Catalog**). *Stellarium* uses the **NGC, IC** and the **M** catalogs. To show the labels in the sky for the brightest and most famous of these Deep Sky objects, press the **Deep Sky Objects** button in the toolbar at the bottom of the screen, or simply press the **D** key. The brightest **NGC/IC/Messier** objects are labeled in the sky.

Use the **Search** window (remember, you can access it simply by pressing the **F3** key) to find and select the Deep Sky Objects below. You may have to zoom in or out to see them and their locations more clearly. If the object is below the horizon right now, press "**G**" to make the ground disappear. Remember, information about the objects appears in the upper left-hand corner of the screen.

- What constellation is the **Dumbbell Nebula** in? _____ What is its M number?_____

- What constellation is the **Trifid Nebula** in? _____ What is its NGC number?_____

- What constellation is the **Ring Nebula** in? _____ What is its M number?_____

- What constellation is the **Pleiades** in? _____

- What constellation is the **Triangulum Galaxy** in? _____

PART B

There have been numerous methods devised over the centuries to identify stars. The oldest and most obvious way is to simply give the stars names. Many of these names have been around for centuries, and many came down to us from the Arabs, who were the world's best astronomers during the Dark Ages, when Western knowledge was almost wiped out after the fall of Rome.

Reset the **Date & Time** to the current time by pressing **8**, or by using the **Date/Time** window. Turn the ground **on** if it is off (the **G** key), and turn the atmosphere **off** (if it is on) by pressing **A.** Make sure the stars' names are displayed by opening the **View** window and putting a check mark next to **Stars** and **Labels and Markers** section of the **Sky** sub-menu. Before you close the **View** window, drag the **slider** next to **Labels and Markers** to about **one third of the way to the right**. Close the **View** window. Finally, press **C** and **V** to see the constellations and their names.

- Pick your three favorite common names from all the named stars you see:
  - _____
  - _____
  - _____

The problem with naming the stars is that there are FAR more stars than names, and people around the world can't even agree on the names that exist! There have been several other, more scientifically precise methods devised to identify stars. The **Bayer** method, created by German astronomer Johann Bayer in 1603, labels the stars in a given constellation using the Greek alphabet, with roughly the brightest star in that constellation called α, after the first letter in the Greek alphabet (for example, α Orion or α Ori for short). The second brightest star is then called β, the third brightest γ, and so on, in the order of the Greek alphabet, which is

α, β, γ, δ, ε, ζ, η, θ, ι, κ, λ, μ, ν, ξ, ο, π, ρ, σ, τ, υ, φ, χ, ψ, ω

In English, these letters are written **alpha, beta, gamma, delta, epsilon, zeta, eta, theta, iota, kappa, lambda, mu, nu, xi, omicron, pi, rho, sigma, tau, upsilon, phi, chi, psi**, and **omega**.

The Bayer method is still in use today, but even *it* can't account for all of the *millions* of stars in the sky! In the 19th and 20th centuries, various exhaustive catalogs of many hundreds of thousands of stars were made, including the **BSC** or Bright Star Catalog, the **HD** or Henry Draper Catalog, and the **HIP** or Hipparcos catalog, which *Stellarium* uses. These catalogs simply number stars. For example, Sirius, the brightest star in the sky, is also known as α Canis Major, or HD 48915 or HIP 32349.

In *Stellarium*, a star's Bayer name is displayed in the second line, below its common name(s). The star's Hipparcos (HIP) catalog number (along with its Flamsteed name and various other catalogue numbers) is listed after the Bayer name.

- What are the Bayer and HIP designations for each of the stars you wrote down above?
  - Star name: _____ Bayer letter: _____ HIP number: _____
  - Star name: _____ Bayer letter: _____ HIP number: _____
  - Star name: _____ Bayer letter: _____ HIP number: _____

- What are the Bayer & HIP designations for the star **Kochab** (in the constellation Ursa Minor)? (Use the **Search** window to find it) Bayer: _____ HIP: _____

- What is the common name for the star **α (alpha) Ursa Major,** also known as **α UMa** ? (Use the **Search** window and the Greek alphabet buttons at the bottom of the search window to find it, or just look for the brightest star in Ursa Major!) _____

- What is the common name for **γ (Gamma) Draco** or **γ Dra** ? _____

PART C

Now that we know how to identify the stars and constellations, let's look at how they move over time.

Zoom out to show the whole sky and center it on the screen, with **North** at the **top** of the screen. Press the **Increase Time Speed** button **three** times on the bottom tool bar and watch the stars move. Remember, you can also do this by pressing the **L** button on the keyboard three times. Each time you press the button, time goes **10 times faster**, so **three** clicks makes time go **1,000** times faster than normal!

- Which way do the stars move as time passes? (W to E? E to W? N to S? S to N?) _____

Find the only star that's not moving. Click on it. What is its name? _____

Why do the stars move the way they do? _____

_____

Display the constellations and their boundaries as you did before (by pressing **C**, **V**, and **B**). As you watch time pass 1,000 times faster than normal, can you find the one constellation that never sets – in other words, that is always out in the sky here in L.A., no matter what time it is? We call a star or constellation that never sets **circumpolar**.

- What is the only completely circumpolar constellation (at least in L.A.)? _____

Press the **Set Normal Time Rate** button to let time pass normally. You can also do this by pressing the **K** button your keyboard.

Change your location to the **North Pole** by opening the **Location** window and clicking on the very top edge of the Earth map. Your latitude should change to **90° North** – the North Pole! Don't worry if you're not exactly at the North Pole – just try to get the Latitude to as close as **90° North** as possible. Close the **Location** window. Now press **L** three times again to make time pass quickly.

- What do the stars do now? _____
- Now where in the sky (not where on the screen!) is the star that doesn't move? _____
- Does this make sense? Explain _____

_____

Press **K**, and then set the location for **Singapore** (open the **Location** window, enter **Singapore** in the **Search box**, and then click on **Singapore, Singapore**), which is almost exactly on the Equator (**Latitude = 0°**). Close the **Location** window. To see the horizon more easily, click on the **Sky and Viewing Options** icon to open the **View** window, click on **Landscape** on the top to open the **Landscape** sub-menu, and then click on **Ocean**. Close the **View** window. Finally, press **L** three times to make time run 1,000 times faster than normal.

- What do the stars do now? _____
- Now where in the sky is the star that doesn't move? _____

- Does this make sense? Explain. _____

_____

Press **K** to make time run normally. Reset the location to **Panama City** and set the time for **12 Noon** on today's date. Press **L** three times again and watch the Sun move.

- Does the Sun move along with the stars? _____
- How about the Moon (if it's visible)? Does it move along with the stars? _____

You now know how stars are named, how they are arranged, and how they move as the hours pass. You're well on your way to becoming an astronomer!

Write a brief conclusion summarizing your results and what you learned in this assignment.

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