Name: _____

Astro 102 – Lab #3

Lab objectives

1) Map out the constellations in the Orion region of the sky
2) Locate and identify dark/reflection/emission nebulas, planetary nebulas and supernova remnants in the Orion sky
3) Learn about the future fate of the stars in the Orion sky

Setup

This lab will be performed in the Stellarium (version 0.16.1 or newer) planetarium program. You can access the Stellarium Planetarium program on specific computers at the following computer labs

- OC Bremerton: ST 122 Computers: 1-4
- OC Poulsbo: OCP 106 Computers: 11-13
- OC Shelton: OCS PA2 Computers: 1-2

or you can download a free copy at http://www.stellarium.org/ (Windows, Mac OS and Linux versions of the program are available). Instructions for installing the program and system requirements can be found in the user's guide. Stellarium may not run properly on Windows Vista. If you encounter some problems, try downloading a different version of Stellarium by clicking on the *"older releases"* link. You can access the user's guide from the link on the Stellarium homepage.
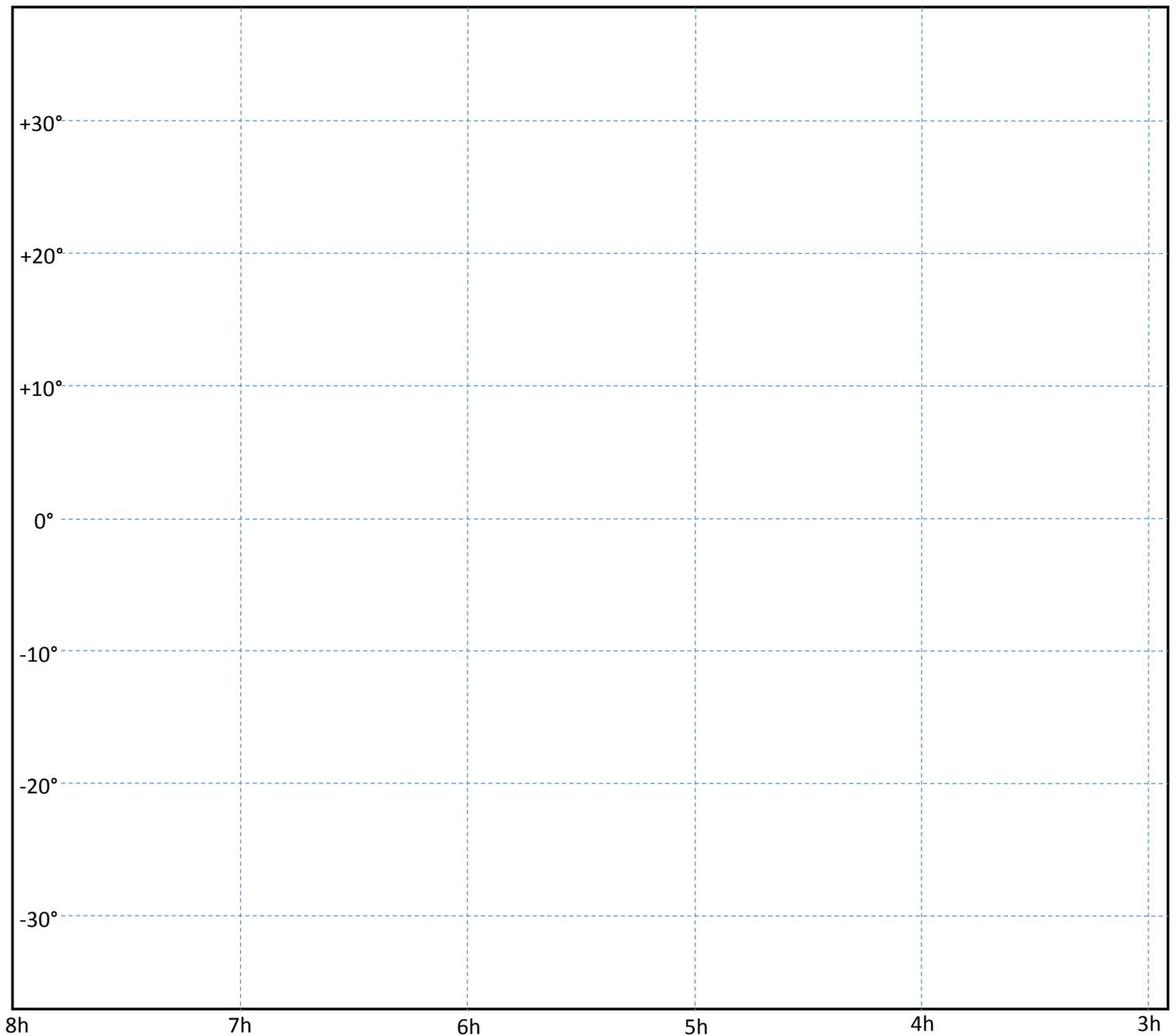
1) Constellations in the Orion sky

1a) Set the location to Seattle and advance time to around 19:30, so that the constellation of Orion is facing South. Click on the *Constellations* Icon and *Constellation Names* Icon on the *Main-Toolbar* to see the constellations in the Orion region of the sky. In the large box on the next page, plot the stars and draw the connecting lines for the following constellations: Orion, Canis Major, Canis Minor, Taurus and Gemini.
Click on the *Equatorial Grid* Icon on the *Main-Toolbar* to bring up grid lines to help align your drawings. (Note: you can project the sky using a 'Cylinder' projection to see rectangular grid lines. Click on the '*Sky and viewing options'* Icon on the *Left-Toolbar*. Select the 'Markings' tab at the top of the *View popup window*. Then select the *Cylinder* option at the bottom of the new window.)

1b) Label the constellations names and label the main stars: Betelgeuse, Bellatrix, Rigel, **Alnilam**, Sirius, Procyon, Castor and Aldebaran.

1c) Starting from the constellation of Orion, use the Orion pointer stars to draw dashed (- - -) lines to the following stars: Sirius, Procyon, Castor and Aldebaran. (Reminder: pointer stars consist of 2 or more stars and the pointer stars will roughly align to the connecting star.)

2) Nebulas in the Orion Sky

2a) In your constellation drawing, map the locations of the following objects: Great Orion Nebula (M42), Horsehead Nebula Region (Barnard 33 + NGC 2023 + IC 434), Witch Head Nebula, Barnard's Loop, Pleiades (including Merope Nebula), Crab Nebula, Spaghetti Nebula, Jellyfish Nebula, Eskimo Nebula, Rosette Nebula, Butterfly Nebula and Thor's Helmet. Label their names (do not label the other objects that are included in that region). Hint: to find these objects, you can use the *Search Window* by clicking on the *Search* Icon on the *Left-Toolbar*. Stellarium does not include images for some of the objects (e.g. Barnard's Loop).

2b) Identify their nebula type(s) with the following abbreviations: *D* – dark nebula, *R* – reflection nebula, *E* – emission nebula (or HII region), *PN* – planetary nebula, and *SNR* – supernova remnant. Some objects have multiple nebula types (e.g. Horsehead Nebula Region: Barnard 33/NGC 2023/IC 434 = *D/R/E*). Hint: Click on the *'Deep-sky objects'* Icon on the *Main-Toolbar*. Point the cursor over the object indicator (usually a green square or circle) and left-click to bring up information about the nebula type.

3) Future fate of the stars in the Orion sky

Star	Mass ($M_\odot$)	Main Sequence Lifespan	Luminosity Class	Evolutionary Stages
Sun	1	10 *B* (Billion)	V	*MS* (Main Sequence) – *G* (Giant) – *PN* (Planetary Nebula) – *WD* (White Dwarf)
Betelgeuse	10		Ib	*SG* (Supergiant) –
Bellatrix[*]	8			
Rigel	20			
Alnilam	40			
Sirius	2			
Procyon	1.5			
Castor	3			
Aldebaran	1.5			

For the stars in the table above, calculate their main sequence lifespans using the equation given in class. Round off your answers to two significant digits and use the following abbreviations: *B* – Billion and *M* – Million. Fill out the Luminosity class for each of the stars. List the evolutionary stages that the stars will undergo from the present to the future (e.g. Betelgeuse will start with *SG* because of its present *Ib* Luminosity Class). Do not list the color transitions during the giant/supergiant stages.

You can use the following abbreviations: *MS* – Main Sequence, *G* – Giant, *SG* – Supergiant, *PN* – Planetary Nebula, *WD* – White Dwarf, *SN* – Supernova, *NS* – Neutron Star, and *BH* – Black Hole.

[*]Note: Bellatrix will lose mass before it reaches its end stages.