Astronomy 112
Observing Project

The *observing project* gives you the opportunity to put classroom learning into practice as you observe and describe select objects in the sky. **Projects are worth *10%* of your final grade**.

You will need ***planetarium*** **software**, **skychart(s)**, a quadrant (see website under 'Class Materials') and **information collected during group & individual outdoor observing sessions**.

**** Projects MUST be completed on the provided pages and submitted via VIULearn as ONE reasonably sized PDF file by the VIULearn stated due date. Late projects will NOT be accepted. ****

Planetarium software

Some exercises **require** the use of *planetarium software* - either *Starry Night* (available in the computer lab located in B315-113 or available separately) or *SkySafari* (available as an inexpensive purchase for your iOS and Android phone or tablet). More information and basic tutorials for both are available on the class website on the 'Class Materials' page.

Location, Date & Time of Computer Observations

Unless otherwise stated set your program to ***Jan 30, 2026*** at ***9:00 pm (PST)*** in Nanaimo (approx 49° N, 124° W) ***for all computer based observations*** (MAKE SURE you 'freeze' the date/time on these settings as described in the online tutorials). ***ANY change(s) from the above date/time/location will be clearly stated***. Check your date/time/location EACH time you begin a new computer observation and (re)set values as needed. If you do NOT set the date/time/location correctly ***your observing results WILL be INCORRECT***.

Group & Indvidual Outdoor Observing Sessions

Computer observations are supplemented with **mandatory** class & individual outdoor observing as the real sky looks very different from a skychart or program! Group sessions include observing with the naked eye, binoculars, and a telescope and take about 1-2 hours. When attending outdoor observing sessions, dress **WARMLY** (hat, gloves, shoes, etc.), and bring **pen/pencil & paper**, **skychart**, and a **(red) flashlight**. There are a **limited number** of these sessions per term.

Some portions of the observing project require independent observations to be made on particular days (or within some set period). There should be enough flexibility in these dates to accommodate work, school schedules and the uncertainty of weather conditions, but even so, **DO NOT** leave it until the last moment. **The observing project CANNOT be done entirely on a computer!**

Quadrant

You will need a quadrant (or equivalent); instructions to build a simple one are given on the website.

Describing Positions of Objects

When describing the location of objects in the sky, imagine helping a (non-astronomy) friend find objects while stargazing. Use* compass directions (N, SE, WSW, etc.) and *approximate* height above the horizon (near horizon, near zenith, 1/2 way in-between, etc.)** ***DO NOT use technical descriptions such as declination, right ascension, azimuth, etc.

Detailed Descriptions

In places throughout the observation project, you will be asked to describe objects ***in detail***. This means exactly that - imagine 'painting a picture' in words. Things to comment on include (*but are not limited to!*) elements such as size, shape, colour, brightness, and distribution of features & textures. Imagine describing what you are viewing to someone who has never seen the object themselves and who will attempt to draw it based *solely* on your description. ***Poor or incomplete descriptions will result in few or no marks on these types of questions!***

Theory

When performing any calculations, show your equation prior to entering numbers and show your steps/work. Be clear and concise, and make sure you have units on your final answers as appropriate!

1). If a nearby star experiences an *angular shift* of P relative to more distant background stars (ie. P is the measured angular separation between the star's leftmost and rightmost positions), the *parallax angle* p for the star is defined as $p = P/2$ and the distance to the star is

$$d = \frac{1}{p} \qquad (1)$$

where d is the distance in *parsecs* (1 pc = 3.26 ly = 3.086×10^{13} km) if p is in arcseconds ($''$).

This apparent motion of nearby stars against a more distant background is due to the change in viewing position as the Earth orbits the Sun. To demonstrate parallax, hold your arm fully extended in front of you and make a fist, thumb up, with distant objects in the background. Alternate closing one eye while looking at your thumb; it should appear to shift position relative to the distant background objects. Of course, your thumb isn't moving; the apparent motion is the result of a change in viewing position as you switch eyes. The amount of parallax or shift relative to the background is dependent on the distance between the object & observer. Try the demo again, but this time with your thumb close to your face instead of at arms length and note the greater apparent shift of your thumb!

Astronomy 112 Observing Project

Constellations & Deep Sky

1. [***3 marks***] Determine the positions of these stars (measure heights using your quadrant; direction is compass/map direction) from a ***single, fixed OUTDOOR location*** (during an observing session or on your own) **within a few weeks** of the specified project observation date & time.

	Date	Time	Height (°)	Direction	Colour
Sirius:					
Betelgeuse:					
Capella:					

These stars vary in how *"steady"* they appear; discuss briefly, noting any trends.

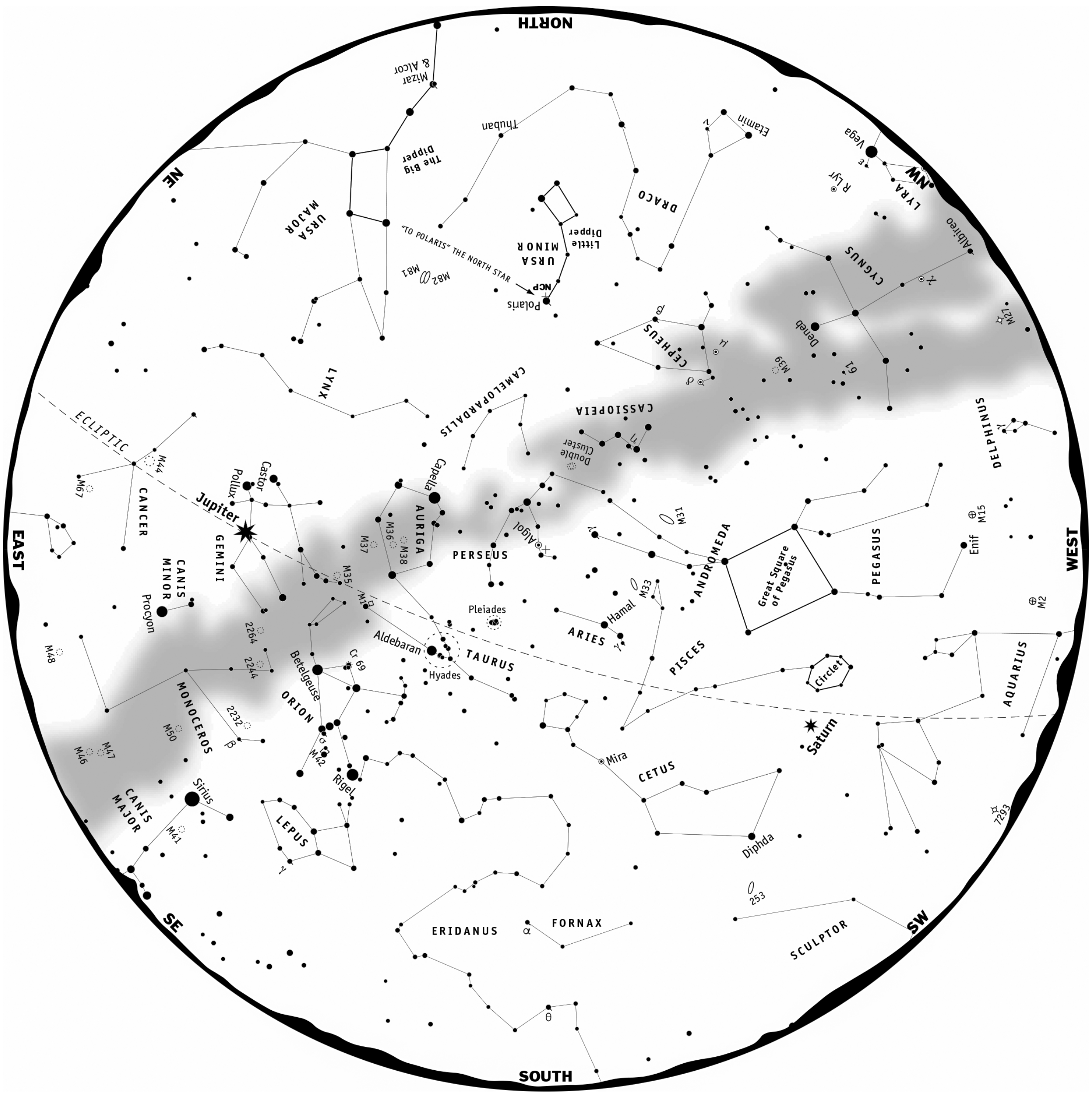
Describe the change in each star's position in a few hours. Does Polaris do the same?

2. [***4 marks***] Some of the better known deep sky objects belong to a list compiled by Charles Messier and are known today as *Messier objects*. Your task is to **identify both the Messier number & common name(s) of the 4 Messier objects *in the order provided* on the *Observing Images* page on the ASTR 112 course website** (under *Info & Handouts*). Set the date & time as specified under Location, Date & Time of Observations. Display both Messier Objects and their labels (if not already enabled on your planetarium software). All objects are visible (above the horizon) on the date/time specified for the project and each has unique features & scale to allow you to identify it - observe carefully! A 30 arcmin (0.5°) field-of-view is indicated for scale in each image; *enable a 0.5° FOV in your planetarium software for easier comparison.*

Object 1	Object 2	Object 3	Object 4
M_____	M_____	M_____	M_____
____________	____________	____________	____________

3. [***5 marks***] Perform the following *naked-eye observations* from a ***single, fixed OUTDOOR location*** (i.e. during a class observing session OR on your own) **within a few weeks of the specified project observation date** (*the skychart provided below should be similar to the 'real' sky within a few weeks of that date & a couple of hours of that time*).

Circle AND number the FIVE (5) brightest naked-eye ASTRONOMICAL OBJECTS (eg. stars, planets) **from 1 - 5** (in order of decreasing brightness). **IN ADDITION, use a HIGHLIGHTER to trace out the FIVE (5) most obvious naked-eye ASTERISMS**; *ONLY highlight those portions of the asterisms that are 'readily obvious' to the naked eye.*

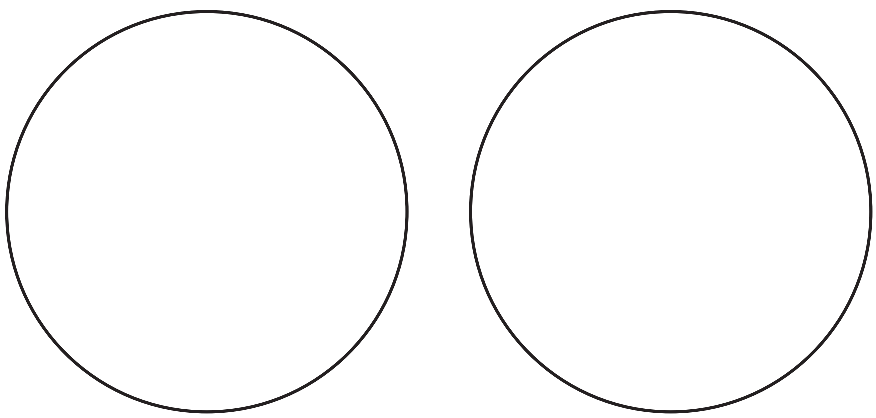


4. [***10 marks***] **Fill in the tables below for the deep-sky object *M1.***

Observing Date	Time	Height (°)	Direction

Common name(s)	
Type of object:	
Resides in constellation:	

HAND DRAW a *detailed, labeled* view of the object in the circular FOV on the left as viewed through a telescope at an observing session OR (if available) from its image on the VIU Rooftop Observing page (course website under Links). **HAND DRAW a *detailed, labeled,* COLOUR view of the object in the circular FOV on the right** as viewed on the same date/time using planetarium software; *ZOOM IN* so the object fills about HALF the screen.

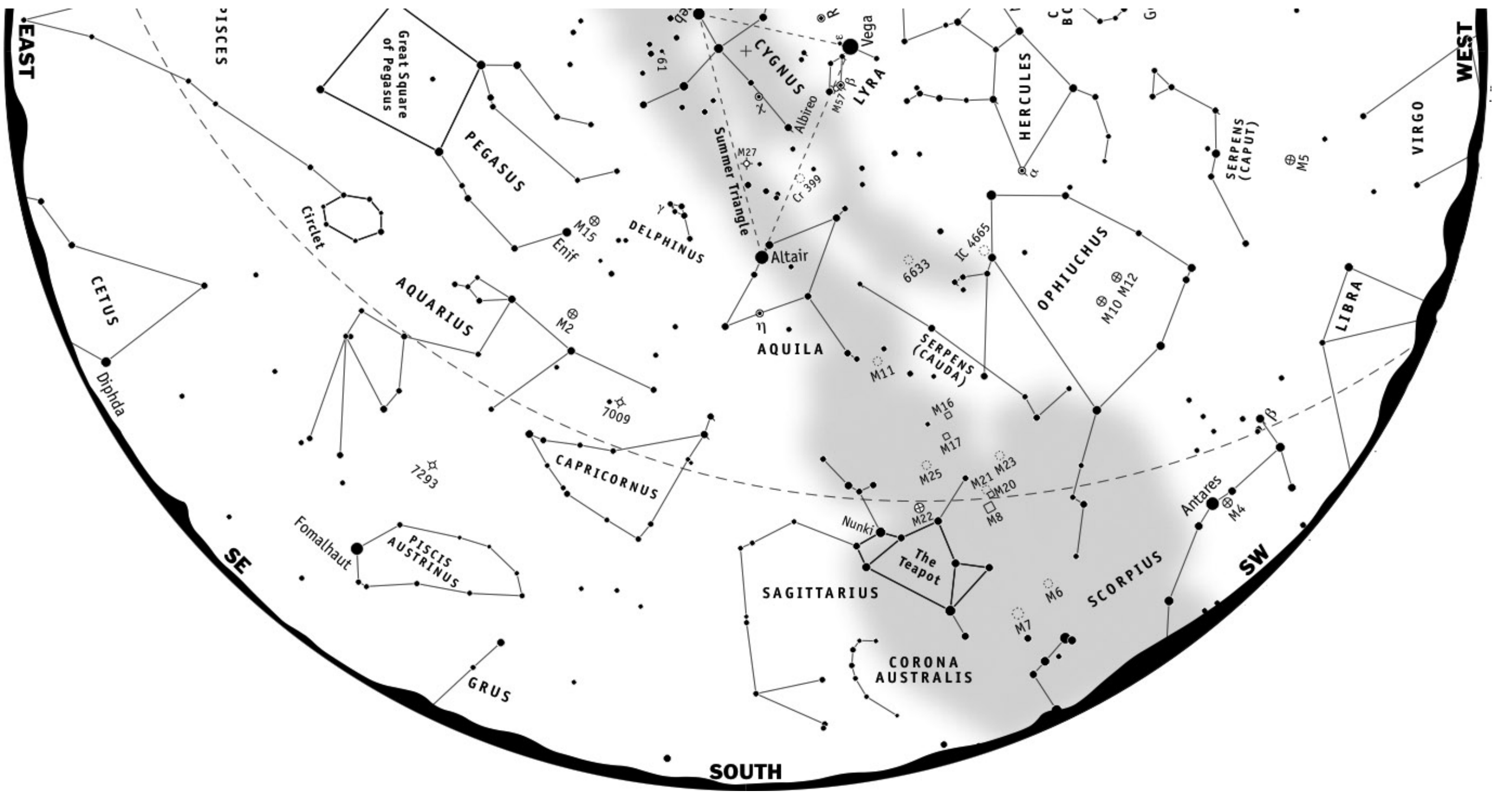


telescope ("live") *planetarium program (colour)*

Describe the object's appearance *in detail* (as seen both during the outdoor observing session AND using the computer). **Comment on SIGNIFICANT differences between the views**.

The Sun

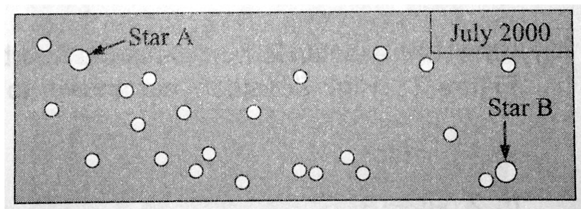
1. [***3 marks***] Set your planetarium program's location to Nanaimo. Turn OFF *show daylight*. Turn ON *constellation lines/figures* & *constellation labels* (see website tutorials/videos for instructions). **STARTING on Dec 1, 2025 and continuing until Apr 6, 2026, record the POSITION of the Sun at NOON at 3 week (21 day) intervals on the skychart fragment below**; make sure *daylight savings time* is OFF. **Mark the Sun's position with a '+' and trace a roughly dime-sized circle around that point; record the date next to each position**.



Is the Sun's position changing as expected relative to the stars? Explain.

Stars

1. [***5 marks***] The figure below shows a small patch of sky containing a field of stars. The SAME starfield is shown on the following page in one month increments over a period of more than a year. During this time period a single star appears to move back-and-forth against the (more distant) background stars, exhibiting what is called *stellar parallax* (see the Theory section for details).



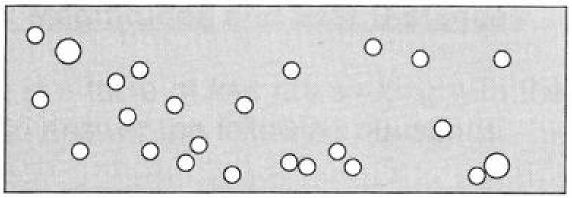
Label stars A & B *on the July 2000 starfield provided ON THE NEXT PAGE*, then use a ruler to measure the (center-to-center) distance between A & B: ________ cm.

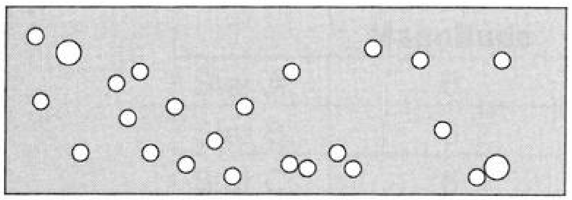
If these stars are 0.5″ apart, **calculate the scale of the starfield**: ________ arcsec-per-cm.

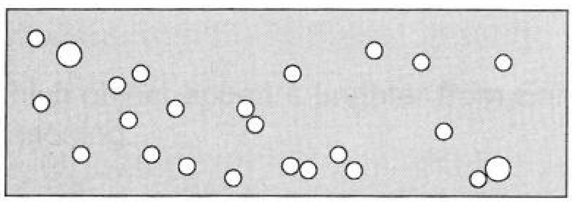
Use a highlighter to colour the ONE moving star in EACH starfield from July 2000 - August 2001. **Mark the TWO ENDPOINTS** (*positions furthest apart*) **during the star's motion with ⊗'s** on the July 2000 starfield. **Use a ruler to measure the (center-to-center) distance between these points**: ________ cm. **Use the scale determined previously to convert this distance into the angular shift** P **of the star**: ________ arcsec and then **take half of this value to find the parallax angle** p **for the star**: ________ arcsec.

Use equation (1) and your value of p **to calculate the distance** d **to this star in *parsecs*; convert your distance to *lightyears***, showing all of your work and calculations fully.

What limitation(s) does this method of distance determination have? Explain.


July 2000


August 2000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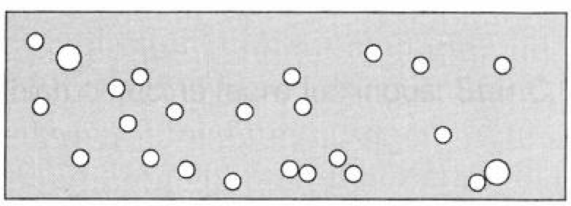
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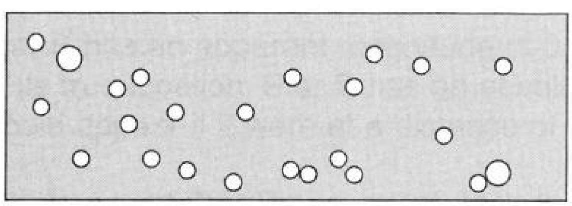
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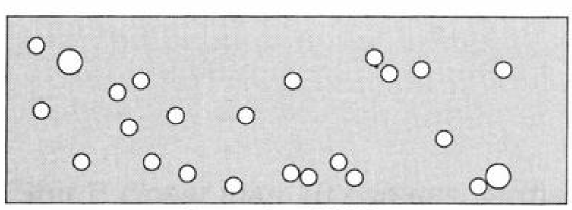
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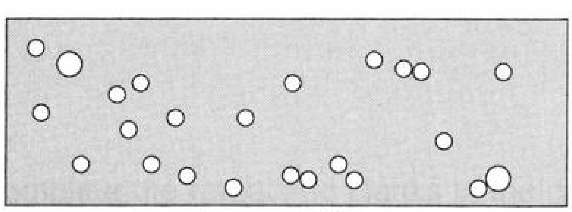
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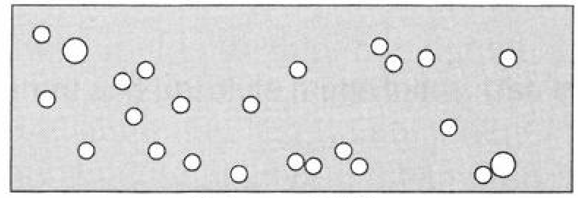
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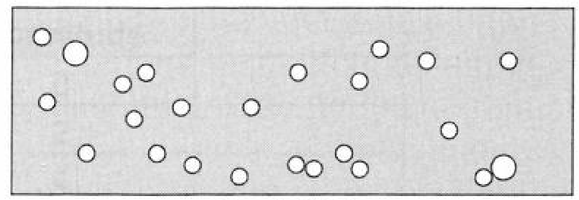
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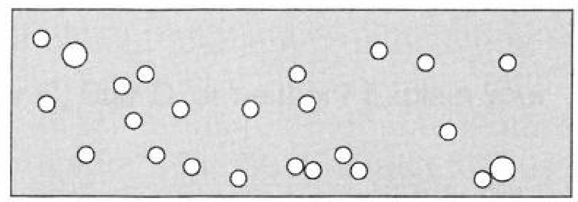
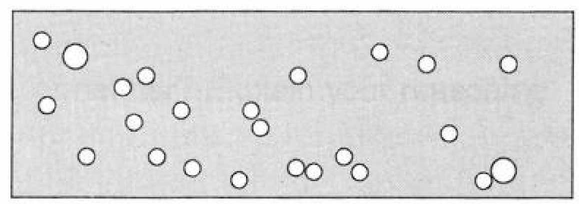

April 2001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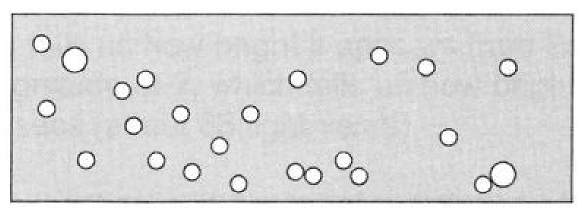
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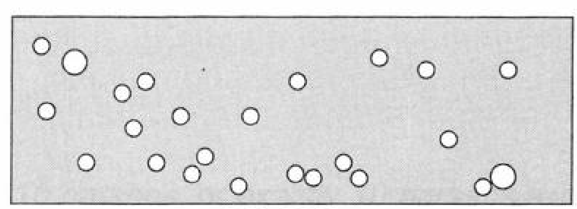
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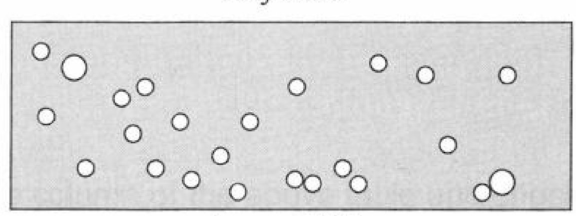
August 2001