The following should give you a bit of a sampling of the types of test questions I may ask and serve as a review for the topics we've discussed so far this semester. On the test I will supply you with any tables of data, equations, or constants that you could need to complete the questions. For the sake of this review, I'm assuming you can use your book to look these types of things up. Also realize that the test will decidedly NOT be this long! I just wanted to toss you a nice batch of questions. You'll likely want to work these through on your own paper except where you need to draw on an image, as I didn't leave you much room...

1. I'm making a scale model of the solar system and I'm using a soccer ball for the Sun. If a soccer ball has a diameter of approximately 22 cm, how far should I place the Earth from the soccer ball to keep everything to scale?

Solution: I'll need to look up the radius of the Sun and Earth's orbital distance from the Sun from a table in your book here. I find that

$$r_{sun} = 695{,}000{,}000\,\mathrm{m} \qquad d_{Earth-Sun} = 149.6 \times 10^9\,\mathrm{m}$$

Now I know the *diameter* of the soccer ball. To compare it to the radius of the Sun I should convert it to a radius. So

$$r_{ball} = \frac{22\,\mathrm{cm}}{2} = 11\,\mathrm{cm} = 0.11\,\mathrm{m}$$

Dividing will now get me my scale factor:

$$\frac{r_{ball}}{r_{sun}} = \frac{0.11\,\mathrm{m}}{695{,}000{,}000\,\mathrm{m}} = 1.58 \times 10^{-10}$$

This is how many *scaled* meters I have to travel to equal 1 *real* meter. So if the Earth is 149.6×10^9 m from the Sun in real life, then it should be

$$\left(149.6 \times 10^9\,\mathrm{m}\right) \times \left(1.58 \times 10^{-10}\right) = 23.58\,\mathrm{m}$$

So we should place whatever is representing the Earth approximately 23.6 meters away from the soccer ball. If you don't like finding scale factors, you could also use a proportion here:

$$\frac{Scaled}{Real} = \frac{r_{ball}}{r_{sun}} = \frac{X}{d_{E-S}}$$

And solve for X that way. Tis the same thing.

2. My star chart tells me that Saturn should be 30° 52′ 31″ above the southern horizon. What angle is this in decimal form?

Solution: There are 60 arcseconds in one arcminute, and 60 arcminutes in 1 degree. So:

$$31'' \times \frac{1'}{60''} = 0.5167'$$

We need to add this to however many arcminute we had initially (52). So now

$$52.5167' \times \frac{1^\circ}{60'} = 0.857^\circ$$

which we add to our initial degrees to get

$$30^\circ + 0.857^\circ = 30.857^\circ$$

3. On Figure 1, indicate where the Southern Celestial Pole is located.

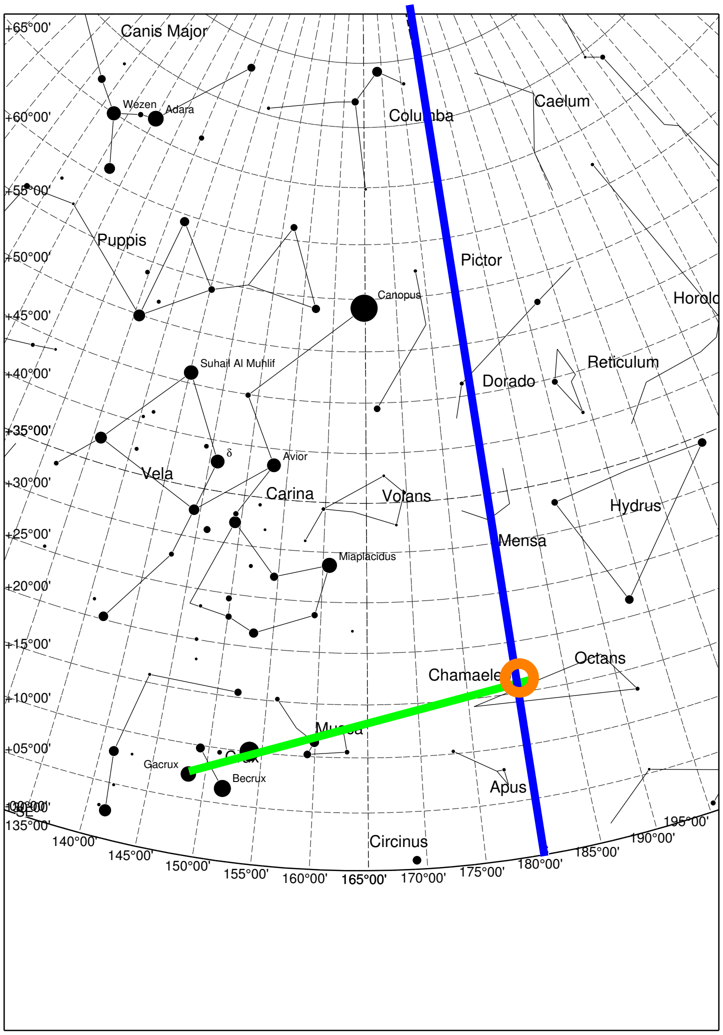


Figure 1: Draw in where the Southern Celestial Pole should be located!

4. I'm looking at the night sky from London, England (51.5 °N, 0.1 °W). Where on the below image should I look expect to see the North star? Draw it's location into Figure 2.

5. Explain what causes the Earth's seasons and why certain areas get warmer than others as a result.

Solution: The Earth's seasons are the result of the Earth's tilt, and have nothing to do with the ellipticity of Earth's orbit. The tilt means that at different times of the year, the southern and northern hemisphere's are receiving more direct sunlight, while the opposite hemisphere receives sunlight at an angle. Direct sunlight is more intense, and thus the hemisphere receiving direct sunlight experiences summer months while the opposite hemisphere experiences winter months. And then the entire situation is reversed when the Earth moves to the opposite side of the Sun.

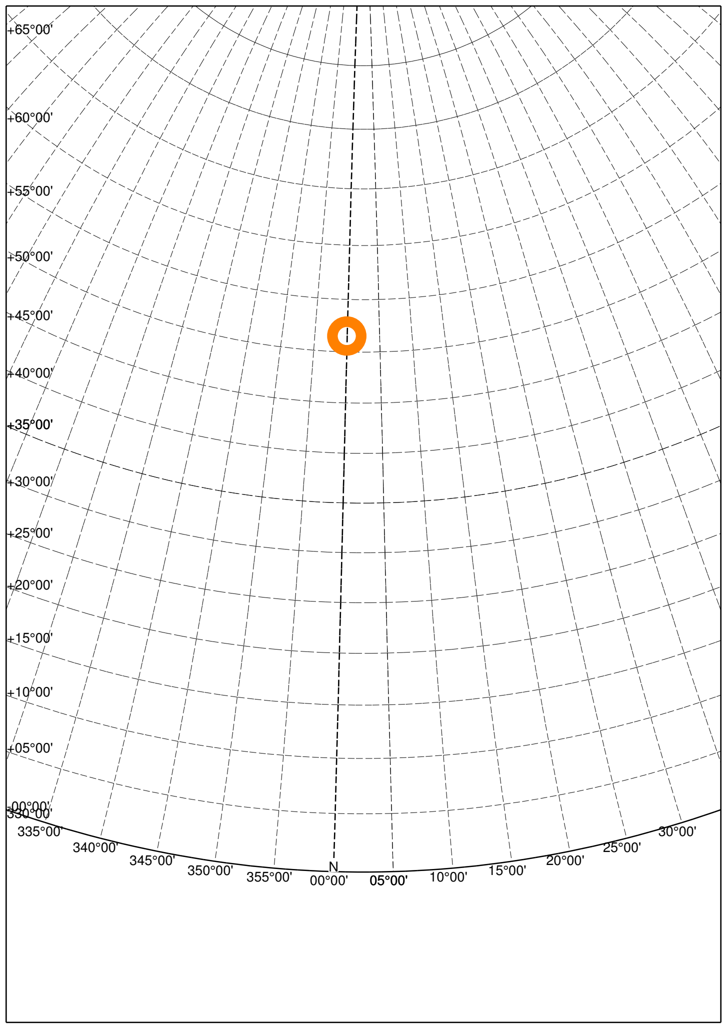


Figure 2: Draw in where you would see the North star from London, England.

6. If the Earth, Moon, and Sun are configured as below (not to scale), what is the current lunar phase as seen by all the Earth-folk? Is it waxing? Waning? Crescent? Gibbous?

Solution: The Sun shining from the left would mean that only the left side of the Moon would be illuminated. At it's current location, that would mean a crescent on the right side would be visible from Earth (orient your page so you are looking though Earth toward the moon if you need to). If the moon continued orbiting counter-clockwise, we would soon seen a quarter moon, which indicates to me that the moon is getting more full. And thus our current moon phase must be a Waxing Crescent.

7. What must the Moon's phase be if someone is witnessing a total solar eclipse from the Earth?

Solution: If we are witnessing a total solar eclipse on Earth, then the Moon must be between the Earth and the Sun. If this is the case, only the far side of the Moon would be lit, and we would be experiencing a new moon.

8. What is planetary retrograde motion?

Solution: Planetary retrograde motion is when planets seem to reverse the direction they are moving through the sky for small segments of their orbit. This is the result of the Earth moving faster through it's orbit and it moves past them. Play with this if you need a visual: `http://physics.unm.edu/Courses/Rand/applets/retrograde.html`.

9. Figure 3 is a sketch of some objects orbit around the Sun. You can assume each gridline is 1 AU. Draw in where the Sun could be located.

Solution: From the orbit I can determine that the orbit has a major axis length of 8 AU and a minor axis length of 6 AU. Thus the semi-major axis (a) is 4 AU and the semi-minor axis (b) is 3 AU. We know the sun is located at one of the foci, and we can find the distance from the center to the foci by

$$f = \sqrt{a^2 - b^2} = \sqrt{4^2 - 3^2} = \sqrt{7} = 2.65 \text{ AU}$$

The foci have to lie on the major axis, so we can place the sun either 2.65 AU above or below the center.

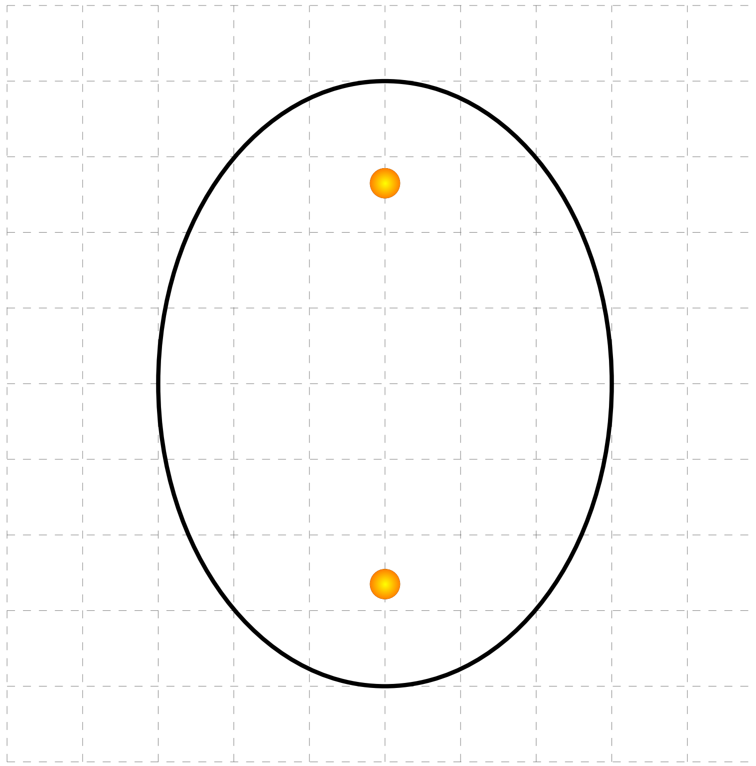


Figure 3: Sketch in where the Sun could be located!

10. Jupiter takes 11.86 yrs to complete one orbit around the Sun and has a mass 1000 times smaller than the Sun's mass. How far is Jupiter from the Sun?

Solution: We know that

$$\frac{a_r^3}{p^2} = M_{tot,\odot}$$

where a_r is in AU, p is in years, and $M_{tot,\odot}$ is in solar mass units. Here our total mass is the mass of the Sun plus the mass of Jupiter, which is solar mass units would look like:

$$M_{tot,\odot} = 1 + \frac{1}{1000} = 1.001 \quad \text{solar masses}$$

Solving for a_r then gives us:

$$a_r^3 = M_{tot,\odot}(p^2)$$
$$a_r = \left(M_{tot,\odot}(p^2)\right)^(1/3)$$
$$a_r = \left(1.001(11.86)^2\right)^{1/3}$$
$$a_r = 5.2\,\text{AU}$$

11. Use Figure 4 to answer the following questions. Each gridline is 100 nm.

    (a) What is the wavelength of this light?

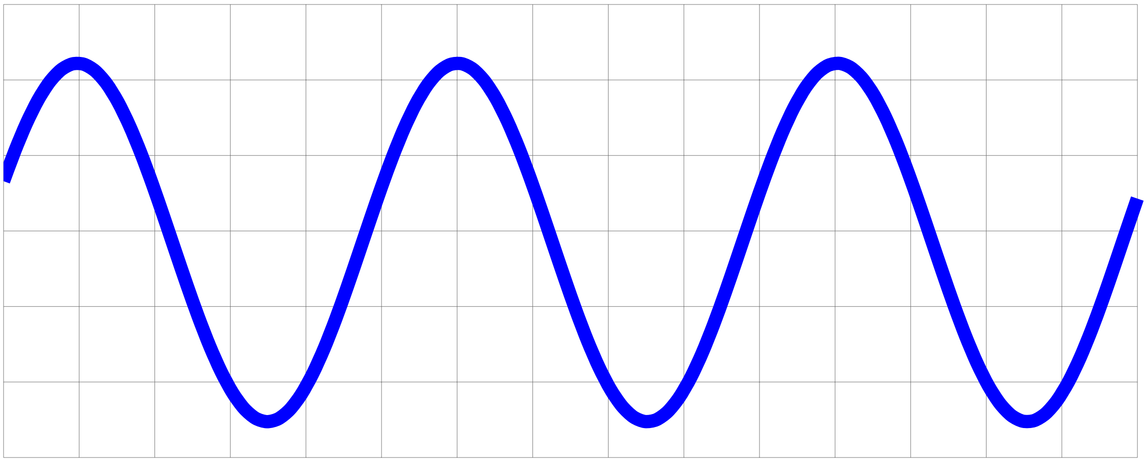


Figure 4: Some particular light wave. . .

Solution: Wavelength is the distance before the wave repeats itself (eg: peak to peak). I could 5 boxes from the top of one peak until the next, and each box is 100 nm, giving me a wavelength of 500 nm.

(b) Approximately what color of light would this correspond to?

Solution: 500 nm would be somewhere between green and blue, or about this color!

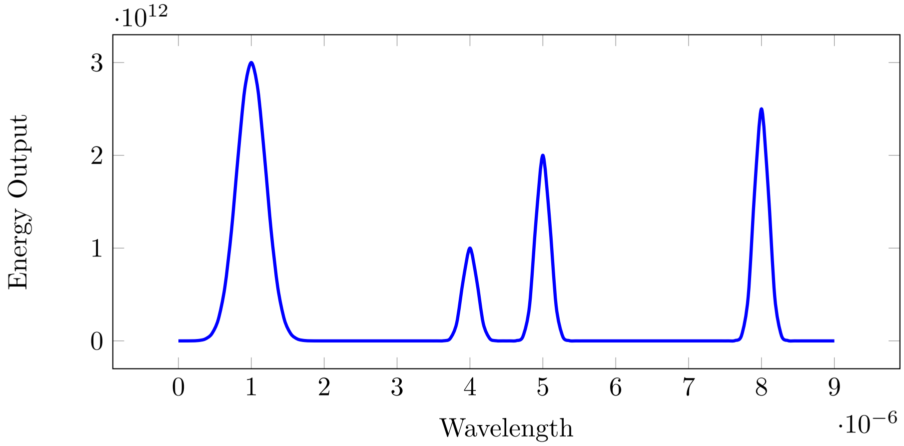
12. Match the below spectra with what could have caused them. Your possibilities are:

    A) A glowing piece of metal

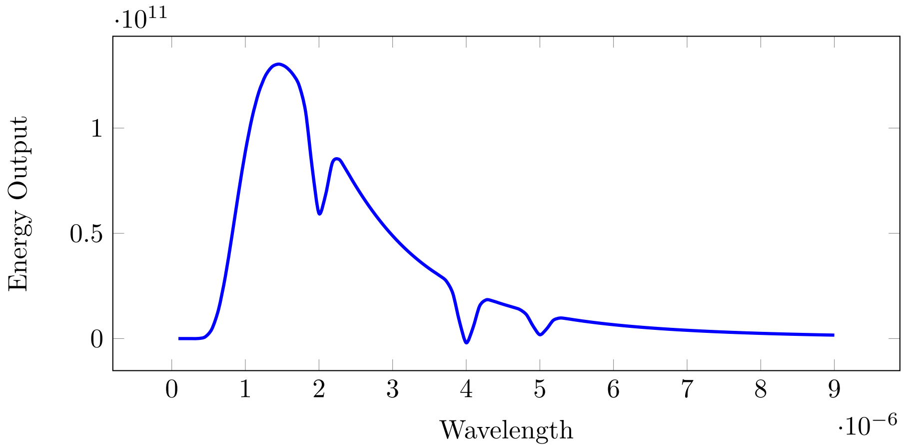
    B) A fluorescent lightbulb

    C) A star

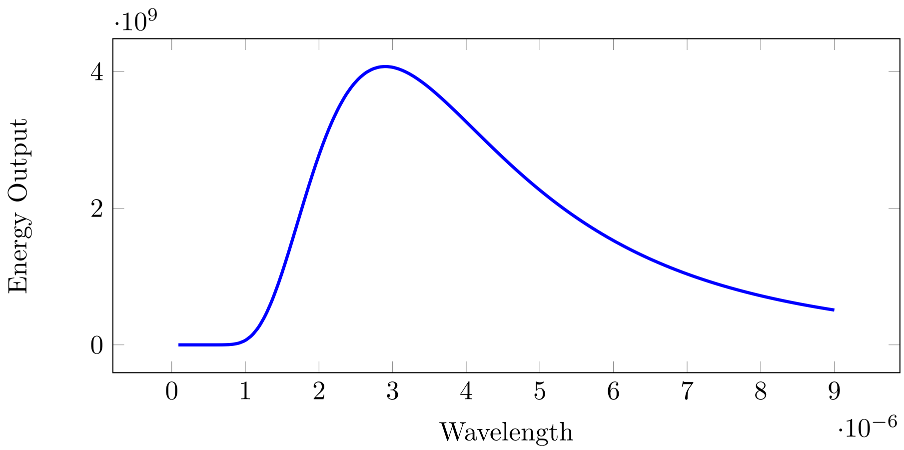
B



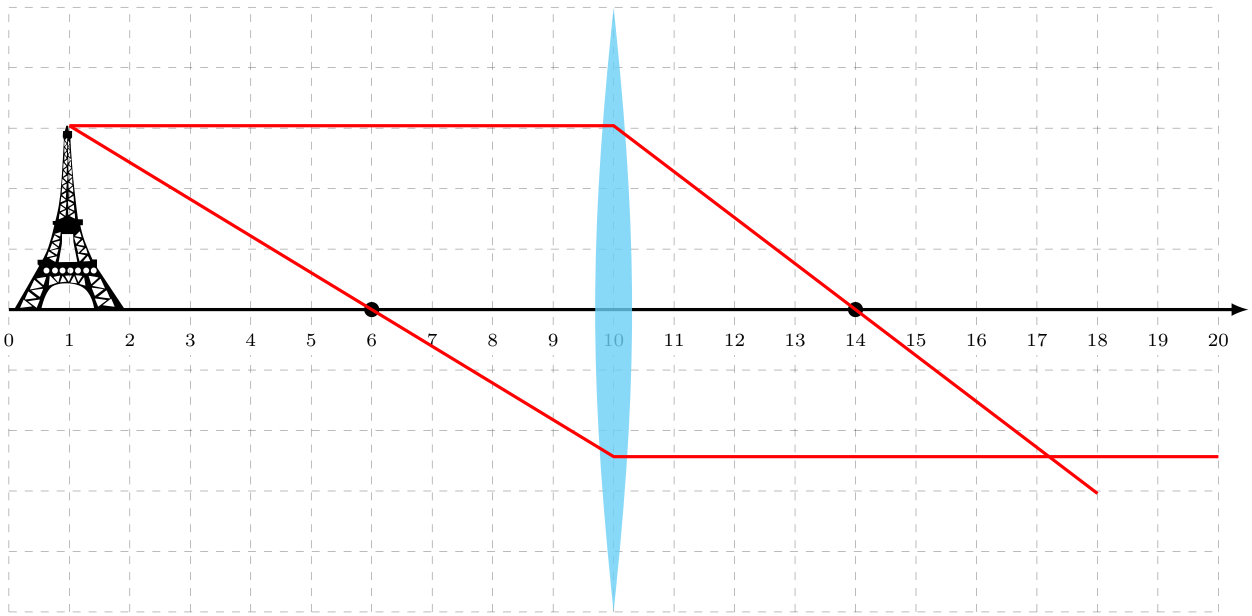
C



A

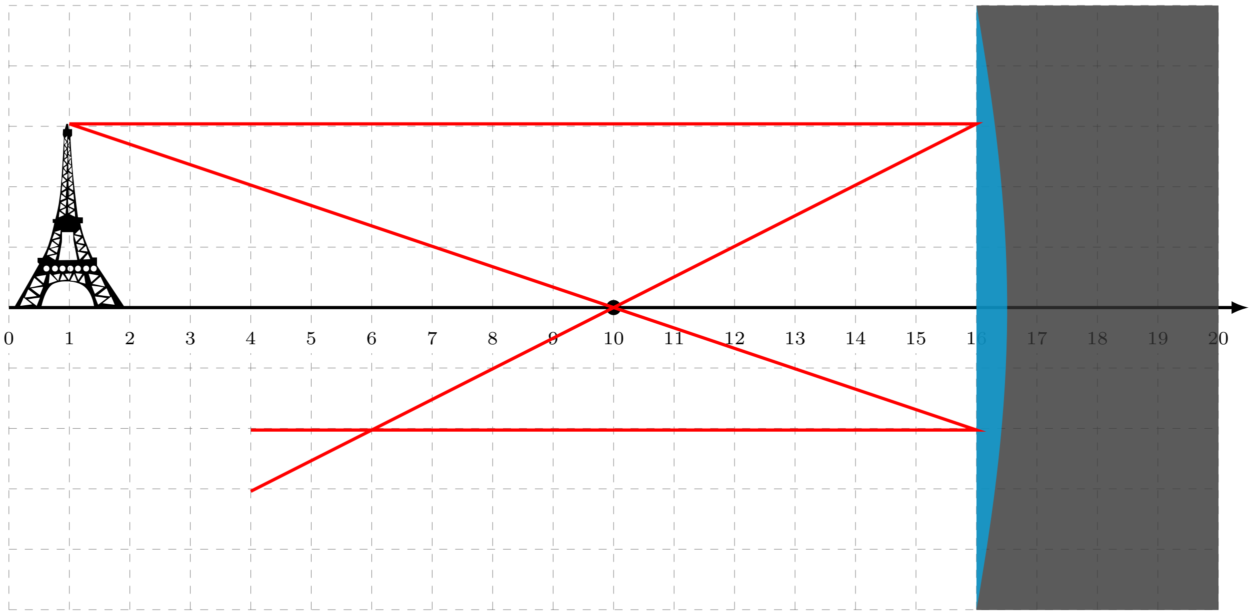


13. You are looking at the Eiffel Tower through the lens below. Given the focal points of the lens, determine the position of the sharp image of the Eiffel Tower. How large would the image of the Eiffel Tower appear?



Solution: We see that the image of our tower would be just past 7 units from the lens, or just past position 17. The image of the tower would only be about 2.3 units high instead of the actual 3 units the tower actually is.

14. You are looking at the same Eiffel Tower, but now through a reflecting mirror. You are told the mirror has a focal length of 6 units. Determine the position and size of the image of the Eiffel Tower.



Solution: We see that the image is located at unit 6 (or 10 units from the mirror) with only a height of 2 units.

15. You wish to view an object that is particularly dim and difficult to see. Which aspect of your telescope should you look to increase to help you better see this object?
    A. The aperture size
    B. The angular resolution
    C. The field of view
    D. The magnification

16. If you want to increase the magnification power of your telescope, you should:
    A. Make your telescope twice as long
    B. Get a telescope with a larger aperture
    C. Remove the secondary mirror from your telescope
    D. Swap out to a different eye-piece

17. When the VLA is in its smallest configuration, is has what properties? Here resolution refers to angular resolution (where smaller is better) and sensitivity refers to light sensitivity (where bigger is better).
    A. Excellent resolution, poor sensitivity
    B. Excellent resolution, excellent sensitivity
    C. Poor resolution, poor sensitivity
    D. Poor resolution, excellent sensitivity

18. I look through my telescope and, despite my best efforts at focusing, I see a blurry image. What is one thing that could be causing this?

Solution: I might just have terrible seeing that night. It is also possible (if observing at large wavelengths) that the size of my telescope is inappropriate for the wavelength that I'm looking at, meaning that the angular resolution is too small (or the smallest angle viewable is too large).