

Midterm Study Guide

Astronomy 122

Introduction:

1. How is modern Astronomy different from Astrology?
2. What is the speed of light? Is it constant or changing?
3. What is an AU? Light-year? Parsec? Which is the smallest? Which is the largest?
4. What does an arcminute measure? An arcsecond? How are they related to degrees?
5. What is the difference between an angular diameter and a linear diameter?
6. Describe the small angle formula.
 - a. What are its components?
 - b. What units does each component need to be in?
 - c. What can we use this formula to find?

Celestial Sphere:

1. What is the difference between a constellation and an asterism?
2. What causes the Sun, Moon, and Stars to rise in the east and set in the west once a day?
3. Does Polaris rise and set every day? Why / Why not?
4. Will Polaris always be the North Star? Why / Why not?
5. Describe a major characteristic of a circumpolar star.
6. Can we see circumpolar stars at the South Pole?
7. Can we see the North Star if we are in the southern hemisphere?
8. How does the latitude of the observer affect the angle at which stars rise and set?
9. Are there places on Earth where stars do not appear to rise or set? How do stars move across the sky in these places?
10. What is the ecliptic?
11. What causes the seasons?
12. What is a solstice? Equinox? How many of each are there? When are they?
13. At what latitudes can the Sun pass through the zenith?

The Moon:

1. Does the Moon rotate on its axis? (If so, how long does it take to make one complete rotation?)
2. Do we see different sides of the Moon throughout the month? Why / Why not?
3. What causes the Moon to have phases?
4. What are the major phases of the Moon?
5. Draw a diagram showing where in the Moon's orbit these phases occur.
 - a. In which phases is the Moon closer to the Sun than Earth?
 - b. In which phases is the Moon farther from the Sun than Earth?
6. Which phases can be seen during the day? Which can be seen at night?
7. If you were standing on the Moon's surface facing the Earth, would the Earth appear to rise or set? Would the Earth go through phases?

8. How much of the Moon's surface is actually lit up by the Sun? Is it always the same amount?
9. How does the Moon's orbital plane compare to the ecliptic plane?
10. Describe what happens during a lunar eclipse.
 - a. How are the Earth, Moon, and Sun aligned?
 - b. Does this correspond to a particular phase of the Moon?
 - c. Where should a person be located on Earth in order to see a lunar eclipse?
11. Describe what happens during a solar eclipse.
 - a. How are the Earth, Moon, and Sun aligned?
 - b. What are the three kinds of solar eclipse?
 - c. Where should a person be located on Earth in order to see a total solar eclipse?
12. Why might a person believe that we should see 1 solar and 1 lunar eclipse each month? Is this correct?

Light:

1. Describe the electromagnetic spectrum. How is it organized?
2. What parts of the spectrum have shorter wavelengths? What parts have longer wavelengths?
3. What parts of the spectrum have smaller frequencies? What parts have longer frequencies?
4. How are wavelength and frequency related?
5. What happens to the energy of a photon as wavelength increases? Decreases?
6. What happens to the energy of a photon as frequency increases? Decreases?
7. What speed does each wavelength of light travel at?
8. Can all wavelengths of light travel through our atmosphere? Which ones can?

Telescopes:

1. What are the three major functions of a telescope?
2. Describe and compare the two kinds of telescope.
3. What kind of problem(s) do we encounter with using each kind of telescope? How can we compensate for or avoid these problems?
4. Where is a good place to put telescopes that observe in the Radio, Infrared, Visible, and X-ray parts of the spectrum?
5. What is angular resolution?
 - a. How does it depend on the size of the telescope and the wavelength of light?
 - b. What is the mathematical formula relating angular resolution, telescope size and wavelength of light? What units are these components in?
 - c. Is there a limit to how much detail telescopes on the Earth can discern? What is the cause of this limit?

Gravity:

1. What does Newton's first law (the law of inertia) tell us?
2. What does Newton's third law (action-reaction) tell us? Give an example of Newton's third law.
3. Acceleration is object's change in _____ or _____ .
4. Why does the Earth orbit the Sun?
5. Gravitational Force – what does it depend on? What is the formula for the gravitational force and what does each term mean? What happens to the gravitational force if you double/triple/quadruple one object's mass? What happens to the gravitational force if you double/triple the distance between the objects?
6. What is Weight? How is it different from Mass? If the Earth doubled/tripled in size, how would your weight and mass change? If the Earth doubled/tripled in mass, how would your weight and mass change?
7. Is your weight in an airplane bigger/smaller/same than on Earth's surface? Why?

Parallax:

1. What is Parallax?
2. What causes us to see parallax?
3. What is the mathematical formula relating distance to the parallax angle? What units do you use for each term in the formula? Parallax angle is defined as a change in star's position over what period of time?
4. What is a parsec?

Hydrostatic Equilibrium & Fusion:

1. What is Hydrostatic equilibrium? What pushes inward? What pushes outward?
2. What powers the Sun?
3. What is the difference between nuclear fusion and fission? Why does fusion release energy? The sun fuses _____ into _____. Why can't we sustain fusion on Earth?
4. What is the strong force? Why is it important?
5. What is a positron? deuterium? neutrino? Detection of which of these proves the fusion in the Sun?
6. Most of the light that we see comes from which layer of the Sun? Which one is the hottest of the Sun's outer layers?
7. What is a Sunspot? Why are the Sunspots dark? Is the number of sunspots constant?

Black Bodies:

1. What is a blackbody? What determines blackbody's color? What is the formula that relates the temperature to the wavelength of the emission peak? What units are used in the formula? If you double/triple/quadruple the temperature of the blackbody, what happens to the wavelength of the emission peak?
2. What is flux? What does it depend on? Write the formula that relates the Flux to the temperature (Stefan-Boltzmann Law). What does each term in the formula mean? If you double/triple/quadruple/half/quarter the temperature, what happens to the flux?
3. What is Luminosity?
4. What does apparent brightness depend on? What happens to the object's apparent brightness if you move it twice/three times/5 times/half/quarter as far away.

Magnitudes:

1. What is apparent magnitude? What is the apparent magnitude of a star that is barely visible by naked eye? The brighter the star, the _____ the magnitude. Difference of 5 magnitudes corresponds to a factor of _____ in brightness. What is the formula that relates the flux ratios and apparent magnitudes of two stars?
2. What is Absolute Magnitude? What happens to the star's absolute magnitude if you move it twice/three times/5 times/half/quarter as far away?
3. What can we tell about star's distance if
 - a. its apparent and absolute magnitudes are equal ($m=M$)?
 - b. its apparent magnitude is higher than its absolute magnitude ($m>M$)?
 - c. its apparent magnitude is lower than its absolute magnitude ($m<M$)?
4. What is the formula relating star's apparent magnitude, absolute magnitude and distance? What units are used in the formula?

Spectra:

1. What are the three kinds of spectra (think Kirchoff's laws)? How do you get each of these spectra? What kind of spectrum does Sun have?
2. What particles are in atom's nucleus? What particles orbit the nucleus?
3. How can an electron get to a higher energy level? What is the ground state? How do you get an absorption line? How do you get an emission line?
4. In what way is an element's spectrum like a fingerprint?
5. Spectral features are related to what physical property of a star?

HR Diagram:

1. What spectral classes do we have? What spectral class is the Sun? What spectral class are the hottest stars? What spectral class are the coldest stars?
2. What parameters does star's luminosity depend on? How can a cold star be very luminous? How can a hot star have low luminosity?

3. If you double/triple/quadruple/half a star's temperature, what happens to the luminosity? If you double/triple/half/quarter a star's radius, what happens to the luminosity? If you double/triple the radius and half/double the temperature, what happens to the luminosity? If you doubled/quadrupled/quartered the radius but luminosity stayed the same, what happened to the temperature?
4. What is the Hertzsprung-Russel Diagram? What are the axes? Where is the main sequence? Where on the diagram are supergiants, giants, white dwarfs, red dwarfs? Where is the Sun? Where on the diagram are most stars and why? What is happening in the core of the main sequence star?
5. What is a rough range of sizes of main sequence stars? Giants? Supergiants? White dwarfs are roughly the size of _____.
6. What is a brown dwarf?
7. What is Kepler's third law? What is Newton's version of Kepler's Third? What units are used in the formula? If the Earth's orbital radius doubled/tripled, what would happen to the period? If the Earth's mass doubled, what would happen to the period?
8. How do we determine the mass of stars?
9. Which stars does the Mass-Luminosity relationship apply to?

Doppler Shift:

1. What is Doppler Shift?
2. What does it depend on?
3. Describe the motion of the star that would have no Doppler shift (2 cases). If a star is moving away/towards us, will its light be shifted to longer or shorter wavelength?

Star Formation:

1. What is the Solar Nebula Theory? What properties of the Solar system support this theory?
2. Where do stars form? How do we know?
3. What can trigger star formation?
4. What will be the result of a collapsing spherical cloud with a spin? Why?
5. Is the collapse of the gas the only process in the star formation? What other (weird) process is going on?
6. How do planets form?