Homework #6

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Number of Questions: 20

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Question 1: (5 points)

Which of the following characteristics of an astronomical telescope is the most important for determining the angular resolution?

- 1. The magnifying power of the telescope.
- 2. The focal length of the objective lens or mirror.
- 3. The focal length of the eyepiece.
- 4. The diameter of the objective lens or mirror.

Save answer

Question 2: (5 points)

In a telescope, to what does the term "aberration" refer?

- 1. The absorption of light by the glass in the lenses.
- 2. The magnifying power of the telescope.
- 3. A fundamental limitation of any telescope to resolve very small details in the image.
- 4. A defect in design that blurs or distorts the image.

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Question 3: (5 points)

When visible light passes through a glass prism or a glass lens, which wavelengths of light are deflected most by the glass?

- 1. The shorter wavelengths.
- 2. The longer wavelengths.
- 3. The light is not deflected by glass because glass is transparent.
- 4. ll wavelengths have their directions changed by the same amount.

Save answer

Question 4: (5 points)

The largest refracting telescope in the world is the 102-cm (40 in.) telescope at Yerkes Observatory, built in 1897. Why have no larger refracting telescopes ever been built?

- 1. Larger lenses have too much chromatic aberration.
- 2. The sagging of larger lenses under their own weight will produce image distortion.
- 3. The thickness of larger lenses will absorb too much light and produce too much spherical aberration.
- 4. Larger lenses produce too much magnification.

Save answer

Question 5: (5 points)

What is a CCD (charge-coupled device)?

- 1. A detector in which a small electric current is controlled by a bimetallic strip that expands and contracts in response to infrared radiation.
- 2. An electronic filter to single out one wavelength or set of wavelengths for studying astronomical objects.
- 3. An array of small light-sensitive elements that can be used in place of photographic film to obtain and store a picture.
- 4. A device in which an image from a photographic plate or film is transferred to a computer by moving static electric charges directly into the computer memory in a manner similar to modern copying machines.

Save answer

Question 6: (5 points)

The main reason for placing a telescope and scientific equipment into an aircraft (SOFIA) in order to carry out infrared astronomy is

- 1. to obtain photographs of resolution higher than can be obtained on the ground.
- 2. to avoid stray IR radiation from the warm Earth and its occupants.
- 3. to avoid the absorption of the IR radiation by water vapor.
- 4. to obtain longer observing times on specific sources by moving in the direction of the Earth's rotation.

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Question 7: (5 points)

Telescopes are placed in space to view distant galaxies primarily

- 1. to get closer to the observed objects.
- 2. to avoid the absorption and distortion of the light or other radiations within the atmosphere of Earth.
- 3. to avoid having to steer the telescope against the Earth's motion.
- 4. to avoid the light pollution from the Earth's populated areas.

Save answer

Question 8: (5 points)

The BIMA array, which is partially owned by UIUC, observes in the

- 1. near infrared
- 2. microwave
- 3. gamma rays
- 4. radio

Save answer

Question 9: (5 points)

The major reason why astronomers seek funds to build larger telescopes is

- 1. to measure a wider spectrum of light from stars.
- 2. to collect more light from distant objects.
- 3. to provide magnified images of stars.
- 4. o bring stars closer to the Earth.

Save answer

Question 10: (5 points)

Which of the following sequences of electromagnetic radiation is correct, in order of increasing

energy of the photons (or quanta)?

- 1. Visible light, microwave, radio waves, infrared rays.
- 2. Radio waves, microwaves, gamma rays, UV radiation.
- 3. Visible light, UV radiation, X rays, gamma rays.
- 4. Gamma rays, radio waves, X rays, infrared rays.

Save answer

Question 11: (5 points)

What changes would you expect to see in the resulting spectrum of emitted light from a piece of metal when it is heated slowly in an intense flame from 500 K to 1500 K?

- 1. The intensity of radiation would increase greatly, while the color would change from blue through white to red.
- 2. The intensity of radiation would increase greatly and its color would change from red through white to blue.
- 3. The intensity of radiation would increase greatly, while its color would remain a dull red.
- 4. The intensity of radiation would increase only slightly, while the color would change from red through white to blue.

Save answer

Question 12: (5 points)

An ideal “blackbody” in physics and astronomy is an object that

- 1. emits only infrared light, and hence appears black to the eye.
- 2. does not emit or absorb any electromagnetic radiation.
- 3. absorbs and emits electromagnetic radiation at all wavelengths.
- 4. absorbs all electromagnetic radiation, but emits none.

Save answer

Question 13: (5 points)

If you want to design a device that will detect animals at night by the radiation that they give off, even if the night is totally dark, to what wavelength range should you make the device sensitive?

1. The ultraviolet.
2. The visual range, like the human eye.
3. No device can detect objects on a totally dark night.
4. The infrared.

Save answer

Question 14: (5 points)

Which of the following statements is true if the star Betelgeuse has a lower surface temperature than the Sun? (Assume that IR means infrared radiation and UV means ultraviolet radiation.)

1. Betelgeuse emits more IR and less UV flux than the Sun.
2. Betelgeuse emits more IR and more UV flux than the Sun.
3. Betelgeuse emits less IR and more UV flux than the Sun.
4. Betelgeuse emits less IR and less UV flux than the Sun.

Save answer

Question 15: (5 points)

Why does the Sun look red when it is setting?

1. Red is the Sun's natural color as determined by Wien's law, but it is only when the Sun is close to the horizon that sunlight can pass through the atmosphere unfiltered.
2. When the Sun is close to the horizon, it is traveling away from us at great speed, and the Doppler shift makes it look red.
3. The Earth's atmosphere scatters longer wavelength light more easily than shorter, so more red light is scattered out of the sunlight and into our eyes.
4. The Earth's atmosphere scatters shorter wavelength light more easily than longer, so more red light is left to reach our eyes.

Save answer

Question 16: (5 points)

The light from a small amount of a particular chemical element, when heated in a lamp (like in class), is found to consist of

1. a pattern of narrow, bright emissions at wavelengths that are specific to the element and different for each element.
2. a continuous spectrum of light from which certain colors are missing or absorbed, the absorbed colors being different for different elements.
3. a pattern of narrow, bright emissions at specific wavelengths that are the same for all elements, only the relative intensities of each line differing for different elements.
4. a continuous spectrum of light whose peak wavelength is specific to the particular element.

Save answer

Question 17: (5 points)

What evidence do we have that the Sun contains the element, iron?

1. Solar spectra show absorption in spectral lines that are characteristic of iron and are unique to it.
2. The peak wavelength of the continuum spectrum of sunlight is characteristic of the emission spectrum of iron, as seen when a piece of iron is heated in the laboratory.
3. Scientists have collected meteorites composed of almost pure iron that have originated in the Sun.
4. Magnetic fields exist in sunspots and on the Sun, and these must be produced by iron in the same way that the Earth's magnetic field is generated.

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Question 18: (5 points)

An astronomer finds a source of light in space that emits light only in specific, narrow emission lines. Kirchhoff's laws lead him to which conclusion?

1. The source cannot consist of gases but must be a solid object.
2. The source is made up of a hot, dense gas.
3. The source is made up of a hot, low-density gas.
4. The source is made up of a hot, dense gas surrounded by a rarefied gas.

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Question 19: (5 points)

The spectrum of a star shows an equivalent set of dark absorption lines to those of the Sun, but with one exception. Every line appears at a slightly longer wavelength, shifted toward the red end of the spectrum. What conclusion can be drawn from this observation?

- 1. A cloud of cold gas and dust surrounds the star and is absorbing light from it.
- 2. The star is moving rapidly toward the Earth.
- 3. The temperature of the star's surface is higher than that of the Sun.
- 4. The star is moving rapidly away from Earth.

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Question 20: (5 points)

As a new star evolves from cool dust and gas to a hot star, the peak wavelength of its spectrum of emitted electromagnetic radiation will

- 1. change from the infrared to the visible wavelengths.
- 2. change from the ultraviolet to the visible range.
- 3. increase from the visible to infrared wavelengths.
- 4. remain the same.

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