Lectures 9 and 10 - Telescopes

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The primary purpose of a telescope is to 1) _____
   A) measure the brightness of stars very accurately.
   B) collect a large amount of light and bring it into focus.
   C) magnify distant objects.
   D) separate light into its component wavelengths.
   E) make distant objects appear nearby.

2) It is diffraction that limits the _____ of a telescope of a given objective diameter. 2) _____
   A) aperture
   B) light grasp
   C) resolution
   D) magnification
   E) interference

3) What do we mean by the *diffraction limit* of a telescope? 3) _____
   A) It describes the maximum exposure time for images captured with the telescope.
   B) It describes the farthest distance to which the telescope can see.
   C) It is the maximum size to which any telescope can be built.
   D) It is the angular resolution the telescope could achieve if nothing besides the size of its light-collecting area affected the quality of its images.

4) The amount of diffraction and thus the resolution of the telescope depends upon 4) _____
   A) whether the telescope is a reflector or refractor.
   B) the wavelength used and the size of the main telescope objective lens or mirror.
   C) the brightness of the object.
   D) the size and sensitivity of the CCD chip used for imaging.
   E) the design of the telescope.

5) What is the resolution of a telescope? 5) _____
   A) its ability to see very faint objects
   B) its ability to distinguish two adjacent objects close together in the sky
   C) its ability to separate light into its component colors for analysis
   D) its ability to focus more than just visible light for imaging
   E) its ability to make distant objects appear much closer to us

6) The angular resolution of an 8 inch diameter telescope is _____ times greater than that of a 2 inch diameter telescope. 6) _____
   A) 16 B) 2 C) 4 D) 9 E) 8

7) What is the light-gathering power of an 8-inch telescope compared to a 4-inch telescope? 7) _____
   A) 8 times better
   B) 32 times better
   C) 4 times better
   D) 16 times better
   E) 2 times better

8) A major advantage of a Newtonian reflector over a refractor is 8) _____
A) the central hole in the mirror is smaller.
B) the elimination of the secondary mirror.
C) its compact size.
D) there are only two lenses to grind.
E) the elimination of chromatic aberration.

9) Green light has a shorter wavelength than orange light. In a 5–inch telescope, green light will 9) _____
A) allow dimmer stars to be observed.
B) reduce the effects of atmospheric turbulence.
C) come to the same exact focus as orange light.
D) provide worse angular resolution than orange light.
E) provide better angular resolution than orange light.

10) Which of the following is NOT a reason to use a reflecting telescope rather than a refractor? 10) _____
A) Lenses absorb light, while mirrors do not.
B) Lenses are subject to chromatic aberration.
C) A lens must have two precision surfaces; a mirror needs only one.
D) Lenses are harder to focus than mirrors.
E) Heavy lenses, which can only be supported at their edges, tend to deform under their own weight.

11) Compared to a 5–inch prime focus reflector, a 5–inch Newtonian reflector will 11) _____
A) have more light gathering power.
B) have the same light gathering power.
C) have more chromatic aberration.
D) have a larger hole in the center of its mirror.
E) be easier to build.

12) The large reflector, the 10 m Keck, gathers _____ light than the 1.0 m Yerkes refractor. 12) _____
A) 10 times more
B) 10 times less
C) an equal amount of
D) 100 times less
E) 100 times more

13) What problem does adaptive optics correct? 13) _____
A) chromatic aberration due to use of only a single lens objective
B) the light pollution of urban areas
C) defects in the optics of the telescope, such as the original Hubble mirror
D) turbulence in the Earth's atmosphere that creates twinkling
E) the opacity of the Earth's atmosphere to some wavelengths of light

14) What is true of radio telescopes? 14) _____
A) They are most sensitive to the opacity of the ozone layer.
B) They are the smallest, most compact telescopes.
C) They can only be used above the atmosphere.
D) They have poorer angular resolution than a refractor of the same size.
E) They have better angular resolution than a reflector.

15) In astronomy, an interferometer can be used to 15) _____
A) decrease the effects of light pollution in getting darker sky backgrounds.
B) yield better seeing conditions with optical telescopes.
C) speed up the processing of CCD images.
D) improve the angular resolution of radio telescopes.
E) increase the sensitivity of infrared telescopes to longer wavelengths.

16) Compared to optical telescopes, radio telescopes are built large because 16) _____
A) radio waves have very long wavelengths.
B) they're less expensive to make than optical telescopes.
C) atmospheric turbulence is more of a problem.
D) radio sources are harder to find.
E) radio waves are absorbed by the atmosphere.

17) One advantage of the Hubble Space Telescope over ground based ones is that 17) _____
A) it is larger than any Earth-based telescopes.
B) its adaptive optics controls atmospheric blurring better.
C) it can make better observations of the ozone layer.
D) it can better focus X-ray images.
E) in orbit, it can operate close to its diffraction limit at visible wavelengths.

18) Which of the following effects is caused by *atmospheric turbulence*? 18) _____
A) twinkling of stars
B) magnification of images
C) light pollution
D) diffraction of light

19) Which of the following is *not* one of the three main categories of observation generally used by astronomers? 19) _____
A) spectroscopy to spread an object's light into a spectrum
B) timing to track how an object's brightness varies with time
C) imaging to get a picture of an astronomical objects
D) filtering to look at just a single color from an object

20) Which of the following wavelength regions *can* be studied with telescopes on the ground? 20) _____
A) infrared, visible, and ultraviolet light
B) all light with wavelengths longer than ultraviolet wavelengths
C) all light with wavelengths shorter than infrared wavelengths
D) radio, visible, and very limited portions of the infrared and ultraviolet regions

21) Suppose you want to determine the chemical composition of a distant planet or star. Which of the following will be most useful to have? 21) _____
A) high angular resolution
B) high spectral resolution
C) a radio telescope
D) high turbulence

22) The most important advantage of CCDs over film is that 22) _____
A) they record colors better than film can.
B) their images never fade, as film can.
C) their images do not have to be developed as film does.
D) they record much more light in a given exposure time.
E) they can cover larger areas of the sky than film can.

23) Which of the following is always true about images captured with X-ray telescopes? 23) _____
A) They always have very high angular resolution.
B) They are always very pretty.
C) They are always shown with colors that are *not* the true colors of the objects that were photographed.
D) They show us light with extremely long wavelengths compared to the wavelengths of visible light.
E) They always are made with adaptive optics.

24) What is a CCD? 24) _____
A) It is an abbreviation for the world's largest operating telescope.
B) It is a unit used by astronomers to measure angular resolution.
C) It is an electronic detector that can be used in place of photographic film for making images.
D) It refers to any kind of instrument that can be hooked up to a telescope.

25) _____ optics deform the shape of the mirror to compensate for the turbulence in the atmosphere and yield a close to diffraction-limited image. 25) _____
A) CCD
B) Parabolic
C) Coherent
D) Adaptive
E) Collimating