

- Which electromagnetic radiation ("light") waves travel with the $\left. \begin{array}{l} \text{fastest} \\ \text{slowest} \end{array} \right\}$ speed?
 - Gamma rays.
 - X rays.
 - Microwave.
 - (There is a tie.)
 - (Unsure/guessing/lost/help!)

- Which electromagnetic radiation ("light") particle is the $\left. \begin{array}{l} \text{most} \\ \text{least} \end{array} \right\}$ dangerous to be exposed to?
 - A gamma ray photon.
 - An x ray photon.
 - A microwave photon.
 - (There is a tie.)
 - (Unsure/guessing/lost/help!)

- Electromagnetic radiation ("light") has:
 - wave properties only
 - particle properties only.
 - both wave properties and particle properties.
 - neither wave properties nor particle properties.
 - (Unsure/guessing/lost/help!)

4. _____ is an example of $\left[\begin{array}{l} \text{wave} \\ \text{particle} \end{array} \right]$ properties of electromagnetic radiation ("light").
- (A) Sound.
 (B) A photon.
 (C) Wavelength.
 (D) Brightness.
 (E) (Unsure/guessing/lost/help!)
5. The $\left[\begin{array}{l} \text{light - gathering} \\ \text{resolving} \\ \text{magnifying} \end{array} \right]$ power of an optical telescope depends on the:
- (A) focal length of the primary lens/mirror.
 (B) focal length of the eyepiece.
 (C) diameter of the primary lens/mirror.
 (D) diameter of the eyepiece.
 (E) (More than one of the above choices.)
 (F) (Unsure/guessing/lost/help!)

(North County Campus Telescopes)

6. The primary focal length for the $\left[\begin{array}{l} \text{Orion® Dobsonian-mount Newtonian focus reflector} \\ \text{Mayflower® SVW refractor} \\ \text{Meade® Schmidt-Cassegrain focus reflector} \end{array} \right]$ telescope is approximately:
- (A) one-half the length of the tube.
 (B) the length of the tube.
 (C) twice the length of the tube.
 (D) three times the length of the tube.
 (E) (Unsure/guessing/lost/help!)

(San Luis Obispo Campus Telescopes)

7. The primary focal length for the $\left[\begin{array}{l} \text{Orion® Dobsonian-mount Newtonian focus reflector} \\ \text{Tasco® refractor} \\ \text{Meade® Schmidt-Cassegrain focus reflector} \end{array} \right]$ telescope is approximately:
- (A) one-half the length of the tube.
 (B) the length of the tube.
 (C) twice the length of the tube.
 (D) three times the length of the tube.
 (E) (Unsure/guessing/lost/help!)

8. Two Orion™ reflector telescopes have mirrors with different diameters and focal lengths. The StarBlast® telescope¹ has a larger diameter and longer focal length mirror than the SkyScanner® telescope². If the same 20 mm focal length eyepiece is used with both

telescopes, the _____ telescope will have more

light - gathering
resolving
magnifying

 power.

- (A) StarBlast®.
- (B) SkyScanner®.
- (C) (There is a tie.)
- (D) (Unsure/guessing/lost/help!)

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9. The eyepiece of an optical telescope is replaced by an eyepiece with different characteristics. This change affects the _____ power of the telescope.

- (A) light-gathering.
- (B) resolving.
- (C) magnifying.
- (D) (Two of the above choices.)
- (E) (All of the above choices.)
- (F) (None of the above choices.)
- (G) (Unsure/guessing/lost/help!)

10. The least important feature to consider when purchasing an optical telescope is the _____ of its images.

- (A) brightness.
- (B) resolution.
- (C) magnification.
- (D) (Unsure/guessing/lost/help!)

11. Two or more optical telescopes can be spaced apart from each other in an interferometer to improve:

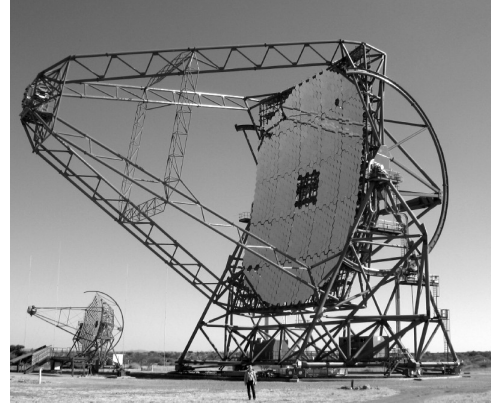
- (A) light-gathering power.
- (B) resolving power.
- (C) magnifying power.
- (D) the amount of light received through the atmosphere.
- (E) (Unsure/guessing/lost/help!)

¹"Orion™ StarBlast® 4.5 Astro Reflector Telescope, 114 mm aperture, 450 mm focal length," bit.ly/XXpRpM.

²"Orion™ SkyScanner® 100mm TableTop Reflector Telescope, 100 mm aperture, 400 mm focal length," bit.ly/YyqFAI.

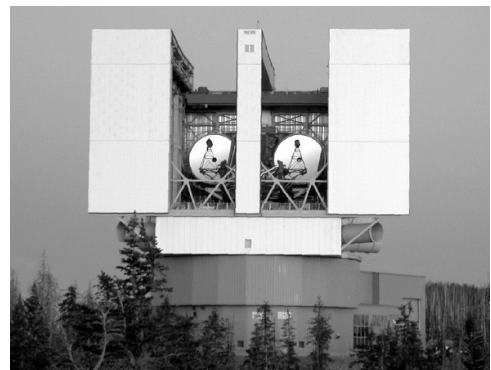
Two of the optical reflector telescopes of the High Energy Stereoscopic System³, located near Windhoek, Namibia have different diameters.

12. The telescope with the _____ diameter has greater light-gathering power.
- (A) smaller.
 - (B) larger.
 - (C) (There is a tie.)
 - (D) (Unsure/guessing/lost/help!)



The two optical reflector telescopes of the Large Binocular Telescope⁴ located at Mt. Graham, AZ have the same diameters.

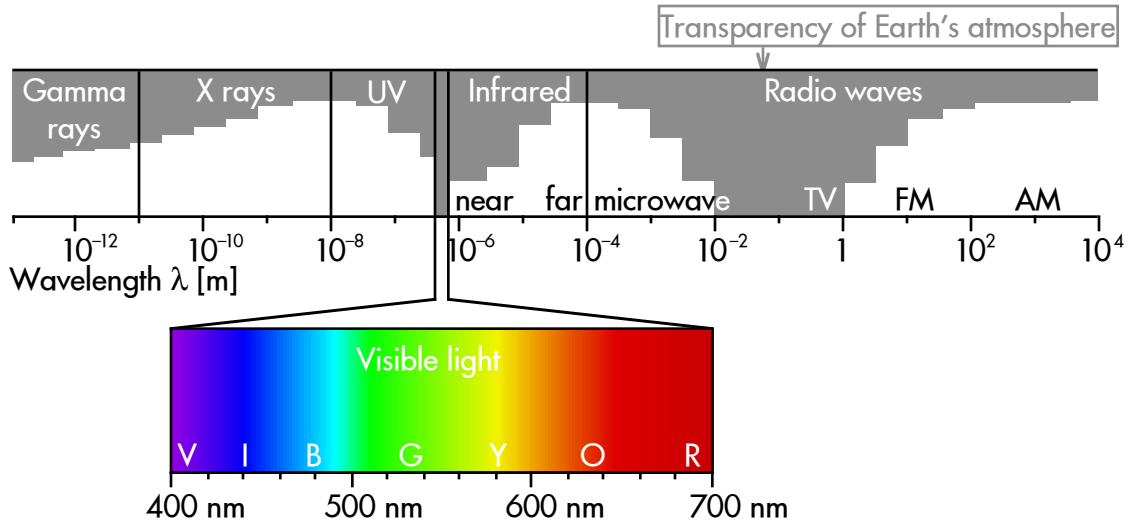
13. The _____ of this system depends on the combined areas of the mirrors of these two optical telescopes.
- (A) light-gathering power.
 - (B) resolving power.
 - (C) magnifying power.
 - (D) (Two of the above choices.)
 - (E) (All of the above choices.)
 - (F) (None of the above choices.)
 - (G) (Unsure/guessing/lost/help!)



14. The mirrors of these two optical telescopes are separated from each other to improve:
- (A) light-gathering power.
 - (B) resolving power.
 - (C) magnifying power.
 - (D) (Two of the above choices.)
 - (E) (All of the above choices.)
 - (F) (None of the above choices.)
 - (G) (Unsure/guessing/lost/help!)

³ Image credit: HESS Collaboration/Stefan Schwarzburg, mpi-hd.mpg.de/hfm/HESS/pages/press/2012/HESS_II_first_light/.

⁴ Image credit: Large Binocular Telescope/NASA, nasa.gov/topics/universe/features/lbti20101206-i.html.
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15. Where

could
should

 you set up a telescope in order to be able to detect

gamma rays
x rays
ultraviolet
visible light
near infrared
radio waves

 ?
- (A) In outer space.
 (B) At very high altitudes (on top of mountains, or carried on balloons or airplanes).
 (C) At sea level.
 (D) (Two of the above choices.)
 (E) (All of the above choices.)
 (F) (None of the above choices.)
 (G) (Unsure/guessing/lost/help!)
16. A(n) _____ telescope would benefit the least by being taken up into outer space.
 (A) gamma ray.
 (B) infrared.
 (C) radio wave.
 (D) (Unsure/guessing/lost/help!)

17. Which optical telescope power(s) would be affected by

- primary diameter
- primary focal length
- light - pollution
- atmospheric turbulence

- (A) Light-gathering power.
- (B) Resolving power.
- (C) Magnifying power.
- (D) (Two of the above choices.)
- (E) (All of the above choices.)
- (F) (None of the above choices.)
- (G) (Unsure/guessing/lost/help!)

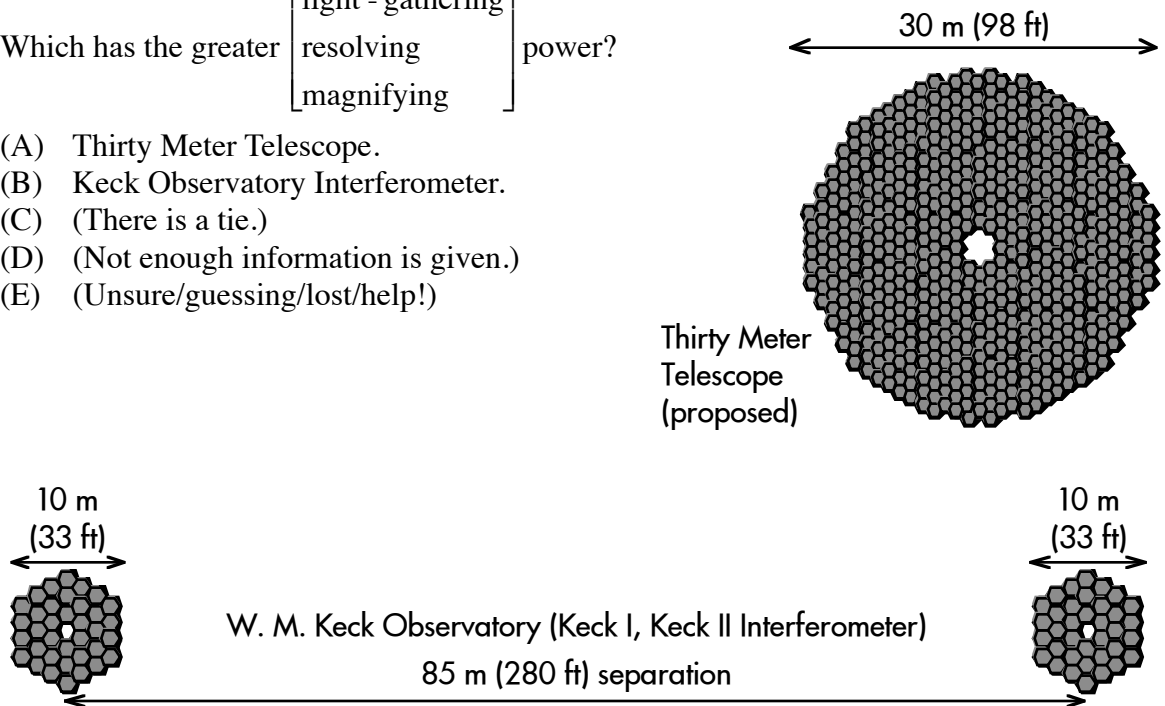
18. Compare the face-on views of the proposed Thirty Meter Telescope with the combination of the two W. M. Keck Observatory telescopes used as an interferometer.

Which has the greater

light - gathering
resolving
magnifying

 power?

- (A) Thirty Meter Telescope.
- (B) Keck Observatory Interferometer.
- (C) (There is a tie.)
- (D) (Not enough information is given.)
- (E) (Unsure/guessing/lost/help!)



19. Large optical telescopes are reflectors rather than refractors because mirrors:
- (A) do not distort colors like lenses.
 - (B) are lighter and easier to support than lenses.
 - (C) can be made of lower quality materials than lenses.
 - (D) (More than one of the above choices.)
 - (E) (Unsure/guessing/lost/help!)
20. Adaptive optics is used in modern optical telescopes to improve:
- (A) light-gathering power.
 - (B) resolving power.
 - (C) magnifying power.
 - (D) the amount of light received through the atmosphere.
 - (E) (Unsure/guessing/lost/help!)
21. Radio telescopes are larger in diameter than optical telescopes in order to have a comparable resolving power because radio waves _____ than visible light.
- (A) travel slower.
 - (B) are more quiet.
 - (C) have longer wavelengths.
 - (D) are more expensive to detect.
 - (E) (Unsure/guessing/lost/help!)
22. Shown at right is the Very Large Array located near Socorro, NM. When these 27 radio telescopes are used, they are spread out from each other to improve:
- (A) light-gathering power.
 - (B) resolving power.
 - (C) magnifying power.
 - (D) the amount of radio waves received through the atmosphere.
 - (E) (Unsure/guessing/lost/help!)

