

NAME: _____

1. Which particles are found in the nucleus of a typical atom? (circle *all* that apply)
a) electrons b) protons c) neutrons
2. Indicate how many of each of the following particles are found in the hydrogen atom (the *entire* atom, not just the nucleus):
electrons: _____ protons: _____ neutrons: _____
3. Indicate how many of each of the following particles are found in the helium atom (the *entire* atom, not just the nucleus):
electrons: _____ protons: _____ neutrons: _____
4. Which of the following particles are made of quarks? (circle *all* that apply)
a) electrons b) protons c) neutrons
5. Which fundamental force is the result of “warped” spacetime?
a) gravity b) the electromagnetic force
c) the strong nuclear force d) the weak nuclear force
6. Which fundamental force holds the nuclei of atoms together?
a) gravity b) the electromagnetic force
c) the strong nuclear force d) the weak nuclear force
7. Which color of visible light corresponds to the lowest energy photons?
a) red b) yellow c) green d) blue e) violet
8. Which color of visible light corresponds to the highest frequency?
a) red b) yellow c) green d) blue e) violet
9. Of all the different kinds of light, which has the longest wavelength?
a) infrared b) radio c) ultraviolet d) X-rays e) gamma rays f) visible light
10. Of all the different kinds of light, which has the highest energy photons?
a) infrared b) radio c) ultraviolet d) X-rays e) gamma rays f) visible light
11. Of all the different kinds of light, which has the lowest frequency?
a) infrared b) radio c) ultraviolet d) X-rays e) gamma rays f) visible light
12. Two of the brightest stars in the sky are *Vega* and *Betelgeuse*. If you look at them carefully you will notice that *Vega* looks blue-ish, whereas *Betelgeuse* looks distinctly reddish. Which star is hotter?
a) Vega b) Betelgeuse c) It is impossible to know just from the color
13. A telescope that uses a lens near the top to focus light is a _____ telescope.
14. A telescope that uses a mirror near the bottom to focus light is a _____ telescope.

(OVER →)

15. Use the equation $E = hf$ to determine the energy of a visible light photon that corresponds to a light wave with frequency $f = 10^{15}$ Hz. (Recall that the value of Planck's constant is $h = 6.6 \times 10^{-27}$.)

16. Use $E = mc^2$ to determine how much energy would be released if a human being who weighs 100 pounds were converted into pure energy. To find the mass in kg of a 100 pound person just divide 100 by 2.2; and remember that the speed of light is $c = 3 \times 10^8$ m/s. Show the steps in your calculation below:

mass, $m = 100$ pounds $\div 2.2 =$ _____ kg



$E = m \times c^2 = ($ _____ kg $) \times (3 \times 10^8$ m/s $)^2 =$ _____ Joules

17–20. For each of the following, identify where it is located, and if it is a telescope what kind of light it is used for.

	TELESCOPE OR OBSERVATORY?	WHERE?	TYPE OF LIGHT? (for telescopes only)
Keck	telescope		
Hale	telescope		
Palomar	observatory		
Mauna Kea	observatory		
the VLA	telescope (and observatory)		
Arecibo	telescope (and observatory)		
Hubble	telescope		