Name: _____ Block:_____ **Energy Homework**

Formulas	Variables / Constants
$c = \lambda\nu$	**c** = speed of light = $\frac{3.00 \times 10^8 \text{ m}}{s}$ λ = wavelength, measured in nanometers 1 nm = 10^{-9} m ν = frequency, measured in $\frac{1}{s} = s^{-1} = Hz$ 1 THz = 10^{12} Hz
$E = h\nu$	**E** = energy, measured in Joules (J) **h** = Planck's constant = 6.626×10^{-34} J•s ν = frequency, measured in $\frac{1}{s} = s^{-1} = Hz$ 1 THz = 10^{12} Hz

1. Violet light has a wavelength (λ) of 4.50×10^{-7} m. What is the frequency (ν)?

$c = \lambda\nu$

$3 \times 10^8 \frac{m}{s} = (4.50 \times 10^{-7} m)(\nu)$

$\nu = 6.67 \times 10^{14} \frac{1}{s}$

2. How much energy (E) does violet light gives off, use the information from question #1.

$E = h\nu$

$E = (6.626 \times 10^{-34} \text{ J}\cdot\text{s})(6.67 \times 10^{14} \frac{1}{s}) = 4.42 \times 10^{-19}$ J

3. Red light has a frequency of 401 THz. What is the wavelength?

$\nu = 401 \text{ THz} \left| \frac{1 \times 10^{12} \text{ Hz}}{1 \text{ THz}} \right. = 4.01 \times 10^{14}$ Hz

$c = \lambda\nu$

$3 \times 10^8 \frac{m}{s} = (\lambda)(4.01 \times 10^{14} \frac{1}{s})$

$\lambda = 7.48 \times 10^{-7}$ m

4. How much energy (E) does red light give off, use the information from question #3.

$E = h\nu$

$E = (6.626 \times 10^{-34} \text{ J}\cdot\text{s})(4.01 \times 10^{14} \frac{1}{s}) = 2.66 \times 10^{-19}$ J

5. Which color, violet or red, gives off the most amount of energy? Violet
6. Which color, violet or red, has the shortest wavelength? Violet
7. Which color, violet or red, has the highest frequency? Violet
8. Calculate the energy (E) of a photon of radiation with a frequency (ν) of 8.5×10^{14} Hz.

$E = h\nu$

$E = (6.626 \times 10^{-34} \text{ J}\cdot\text{s})(8.5 \times 10^{14} \frac{1}{s}) = 5.6 \times 10^{-19}$ J

9. Calculate the wavelength (λ) for the photon in question #8.

$c = \lambda\nu$

$3 \times 10^8 \frac{m}{s} = (\lambda)(8.5 \times 10^{14} \frac{1}{s})$

$\lambda = 3.5 \times 10^{-7}$ m

10. Put answers in table below:

Question number	Wavelength (m)	Frequency (s^{-1})	Energy (J)	**Determine type of radiation for each**
1	4.50×10^{-7} m	6.67×10^{14} $\frac{1}{s}$	4.42×10^{-19} J	visible
3	7.48×10^{-7} m	4.01×10^{14} $\frac{1}{s}$	2.66×10^{-19} J	visible
8	3.5×10^{-7} m	8.5×10^{14} $\frac{1}{s}$	5.6×10^{-19} J	ultraviolet

11. Rank these parts of the electromagnetic spectrum from lowest energy (1) to highest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
7	3	2	1	4	5	6

12. Rank these parts of the electromagnetic spectrum from lowest frequency (a) to highest (g):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
g	c	b	a	d	e	f

13. Rank these parts of the electromagnetic spectrum from shortest wavelength (A) to longest (G):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
A	E	F	G	D	C	B

14. Describe the relationship between wavelength and frequency.

As wavelength increases, frequency decreases

15. Is the relationship between wavelength and frequency directly proportional or inversely proportional?

inversely proportional

16. Describe the relationship between wavelength and energy.

As wavelength increases, energy decreases

17. Is the relationship between wavelength and energy directly proportional or inversely proportional?

inversely proportional

18. Describe the relationship between frequency and energy.

As frequency increases, energy increases

19. Is the relationship between frequency and energy directly proportional or inversely proportional?

directly proportional

20. Summary: Circle the correct answer to show the relationship between the variables.

(long/short) **wavelength** (λ) = (high/low) **Frequency** (ν) = (high/low) **Energy** (E)