Name $\qquad$

## Review Sheet for EM Waves, Light, and Mirrors

## Topics to know:

- Particle-wave theory (Newton, Huygens, Einstein)
- Galileo and his speed of light calculation (why it failed)
- Light as an EM (electromagnetic) wave (be familiar with the EM spectrum)
- $\mathrm{c}=3.00 \times 10^{8} \mathrm{~m} / \mathrm{s}$
- Notes on Reflection
- Shadows
- Ray Diagrams, pinhole cameras, locating images in mirrors, etc.
- All of the worksheets completed and discussed in class

1. Which of the following electromagnetic waves travels fastest in a vacuum?
a. green light
c. gamma rays
b. infrared light
d. they all have the same speed
2. Find the frequencies of electromagnetic waves with wavelengths of
a. 3.0 cm
b. 650 nm
c. 1.2 mm
3. A meteorologist in a TV station is using radar to determine the distance to a cloud. He notices that a time of 0.24 ms elapses between the sending and the return of a radar pulse. How far away is the cloud?
4. The angle of incidence is the angle between
a. the incident ray and the reflecting surface
b. the incident ray and the normal to the surface
c. the incident ray and the reflected ray
d. the reflected ray and the normal to the surface
5. The angle of incidence of a light ray on a mirrored surface is $35^{\circ}$. What is the angle between the incident and reflected rays? (Hint: Sketch a diagram, it will help you see what angle you are looking for...)
6. A plane mirror
a. has a greater image distance than object distance
b. produces a virtual, upright, unmagnified image
c. changes the vertical orientation of an object
d. reverses an object's top and bottom
7. A plane mirror
a. produces both real and virtual images
b. always produces a virtual image
c. always produces a real images
d. produces an image by diffuse reflection
8. Why do some emergency vehicles have $\boldsymbol{\Psi}$ ЭИА,IU\&MA printed on the front?
9. A person stands 2.0 m away from the reflecting surface of a plane mirror.
a. What is the distance between the person and his or her image?
b. What are the image characteristics?
10. Commercial trucks cause about 18,000 lane-change and merging accidents per year in the United States. To prevent many of them, a warning system covering blind spots is being developed. The system uses electromagnetic waves of frequency $2.40 \times 10^{10} \mathrm{~Hz}$. What is the wavelength of those waves?
11. A typical compact disc stores information in tiny pits on the disc's surface. A typical pit size is $1.2 \mu \mathrm{~m}$. What is the frequency of electromagnetic waves that have a wavelength equal to the typical CD pit size?
12. A new antiterrorist technique detects the differences in electromagnetic waves emitted by humans and by weapons made of metal, plastic, or ceramic. One possible range of wavelengths used with this technique is from 2.0 mm to 5.0 mm . Calculate the associated range of frequencies.
13. The U.S. Army's loudest loudspeaker is almost 17 m across and is transported on a special trailer. The sound is produced by an electromagnetic coil that can generate a minimum frequency of 10.0 Hz . What is the wavelength of these electromagnetic waves?
14. Radio waves can have a wavelength as large as a football field. A football field is 100 yards long. What is the frequency of a wave that has this wavelength?
15. An object and mirror are viewed from above as seen in the diagram below. Use a protractor to locate the three points and then sketch the image using a dashed line.

