Eight multiple choice questions, 6 points each, except question 8 is worth 8 points. Choose the **best** or **most nearly correct** answer.

1. Light is shining upon a glass-diamond interface. ($n_g = 1.5$ and $n_d = 2.4$) The angle of incidence is increased until the light is totally internally reflected. Which of the following is true?
   [A] The light originates in the glass with the incident angle less than the critical angle for glass-air interfaces.
   [B] The light originates in the glass with the incident angle greater than the critical angle for glass-air interfaces.
   [C] The light originates in the diamond with the incident angle less than the critical angle for diamond-air interfaces.
   [D] The light originates in the diamond with the incident angle greater than the critical angle for diamond-air interfaces.

2. A concave mirror with a 20 cm radius of curvature forms a real image that is twice as big as the object. Where is the image?
   [A] 15 cm in front of the mirror
   [B] 15 cm behind the mirror
   [C] 30 cm in front of the mirror
   [D] 30 cm behind the mirror
   [E] 60 cm in front of the mirror
   [F] 60 cm behind the mirror

3. You are told that a mirror forms a virtual image that is smaller than the object. Which of the following is true?
   [A] It is a convex mirror. The image is behind the mirror and erect.
   [B] It is a concave mirror. The image is behind the mirror and erect.
   [C] It is a convex mirror. The image is in front of the mirror and inverted.
   [D] It is a concave mirror. The image is in front of the mirror and inverted.

4. A GaN violet laser, with wavelength 405 nm, is directed at a double slit apparatus yielding an interference pattern on a screen. The laser is replaced by a HeNe red laser, with wavelength 633 nm. The new interference pattern ...
   [A] has a smaller spacing between fringes than the original pattern.
   [B] has the same spacing between fringes as the original pattern.
   [C] has a larger spacing between fringes than the original pattern.
   [D] relative spacing cannot be determined relative to original pattern from the given information.

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5. A thin film of water covers a glass surface as shown in the diagram. For which water thickness will normally-incident light with a wavelength of λ in air undergo constructive interference?

[A] $\dfrac{\lambda}{2n_g}$

[B] $\dfrac{\lambda}{2n_w}$

[C] $\dfrac{\lambda}{4n_g}$

[D] $\dfrac{\lambda}{4n_w}$

Air	$n_a = 1.0$
Water	$n_w = 1.3$
Glass	$n_g = 1.5$
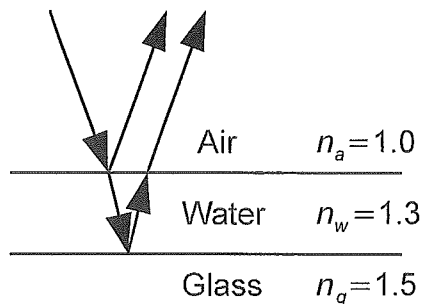
6. Light of wavelength 595 nm is diffracted from a single slit of width 200 μm yielding a distance of 1.2 cm between dark fringes on a distant screen. If the slit is replaced by a slit of width 600 μm, the distance between dark fringes will be …
[A]   0.4 cm.
[B]   1.2 cm.
[C]   1.8 cm.
[D]   3.6 cm.

7. Two emission lines are not quite resolved by an apparatus where the light shines upon a portion of a diffraction grating and produces a pattern on screen. In an attempt to resolve the two lines, one should …
[A]   decrease the distance between the diffraction grating and the screen.
[B]   increase the distance between the diffraction grating and the screen.
[C]   switch to a diffraction grating with a smaller distance between slits.
[D]   switch to a diffraction grating with a larger distance between slits.

8. The most important consequence of this set of material is that it …
[A]   leads to the creation of reading glasses for faculty.
[B]   teaches ninjas how to bend light.
[C]   helps people resolve issues in spite of interference, by considering multiple angles.
[D]   causes us to reflect critically on the nature of light.
[E]   inspired an iconic album cover.

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