1. Since it is a positive diverging lens, the eye is hyperoptic.

2. The image is blurry because the index of refraction of water is 1.33. Light rays bend differently, because of the larger index, and the rays won't focus on the retina.

Goggles hold air next to the eye so the eye will function normally. The image is just magnified because of the water - glass (or plastic) interface (see p. 93, problem 8)

3. For a myopic person, their eyes appear smaller.
For a hyperopic person, their eyes appear larger.

4. Distant object $f = ?$ $d_i = 0.02m$ $d_o \rightarrow \infty$

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} \rightarrow = \frac{1}{d_i} \quad \text{when } d_o \rightarrow \infty.$$

$$\frac{1}{f} = \frac{1}{d_i} \qquad f = d_i = 0.02m$$

$$P = \frac{1}{f} = \frac{1}{0.02m} = 50\delta$$

Near object $d_i = 0.02m$ $d_o = 0.4m$

$$P = \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{0.02m} + \frac{1}{0.4m}$$

$$P = 52.5\ \delta$$ Accomodation of 2.5 δ

5.

a) A hardened lens that does not allow the eye to accomodate & see closer than 45 cm.

b) $d_i = 1.7\text{cm}$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{45\text{cm}} + \frac{1}{1.7\text{cm}}$$

$$f = 1.638\text{cm}$$

Now, what f would be need to focus an object @ 25cm

$$\frac{1}{f} = \frac{1}{25\text{cm}} + \frac{1}{1.7\text{cm}} =$$

$$f = 1.592\text{ cm}$$

$$P_{tot} = P_1 + P_2 = \frac{1}{f_1} + \frac{1}{f_2}$$

The combined lens must have a $f_{tot} = 1.592\text{cm}$
The actual lens is $f_1 = 1.638\text{ cm}$

The glasses would be f_2.

$$\frac{1}{f_{tot}} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$f_2 = \left(\frac{1}{f_{tot}} - \frac{1}{f_1}\right)^{-1} = \left(\frac{1}{1.592\text{cm}} - \frac{1}{1.638\text{cm}}\right)^{-1}$$

$$f_2 = 56.3\text{cm}$$

Positive lens with $f_2 = 56.3\text{cm}$