24. (a) Since this is a converging lens ("C") then $f > 0$, so we should put a plus sign in front of the "10" value given for the focal length. There is not enough information to determine r_1 and r_2. Eq. 35-9 gives

$$i = \frac{1}{\frac{1}{f} - \frac{1}{p}} = \frac{1}{\frac{1}{10} - \frac{1}{20}} = +20 \text{ cm} .$$

There is insufficient information for the determination of n. From Eq. 35-6, $m = -20/20 = -1.0$. The image is real (since $i > 0$) and inverted (since $m < 0$). The ray diagram would be similar to Fig. 35-14(a) in the textbook.

(b) Since $f > 0$, this is a converging lens ("C"). There is not enough information to determine r_1 and r_2. Eq. 35-9 gives

$$i = \frac{1}{\frac{1}{f} - \frac{1}{p}} = \frac{1}{\frac{1}{10} - \frac{1}{5}} = -10 \text{ cm} .$$

There is insufficient information for the determination of n. From Eq. 35-6, $m = -(-10)/5 = +2.0$. The image is virtual (since $i < 0$) and upright (since $m > 0$). The ray diagram would be similar to Fig. 35-14(b) in the textbook.

(c) We are told the magnification is positive and greater than 1. Scanning the single-lens-image figures in the textbook (Figs. 35-13, 35-14 and 35-16), we see that such a magnification (which implies an upright image larger than the object) is only possible if the lens is of the converging ("C") type (and if $p < f$). Thus, we should put a plus sign in front of the "10" value given for the focal length. Eq. 35-9 gives

$$i = \frac{1}{\frac{1}{f} - \frac{1}{p}} = \frac{1}{\frac{1}{10} - \frac{1}{5}} = -10 \text{ cm} ,$$

which implies the image is virtual. There is insufficient information for the determinations of n, r_1 and r_2. The ray diagram would be similar to Fig. 35-14(b) in the textbook.

(d) We are told the magnification is less than 1, and we note that $p < |f|$). Scanning Figs. 35-13, 35-14 and 35-16, we see that such a magnification (which implies an image smaller than the object) and object position (being fairly close to the lens) are simultaneously possible only if the lens is of the diverging ("D") type. Thus, we should put a minus sign in front of the "10" value given for the focal length. Eq. 35-9 gives

$$i = \frac{1}{\frac{1}{f} - \frac{1}{p}} = \frac{1}{\frac{1}{-10} - \frac{1}{5}} = -3.3 \text{ cm} ,$$

which implies the image is virtual (and upright). There is insufficient information for the determinations of n, r_1 and r_2. The ray diagram would be similar to Fig. 35-14(c) in the textbook.

(e) Eq. 35-10 yields $f = \frac{1}{n-1}(1/r_1 - 1/r_2)^{-1} = +30$ cm. Since $f > 0$, this must be a converging ("C") lens. From Eq. 35-9, we obtain

$$i = \frac{1}{\frac{1}{f} - \frac{1}{p}} = \frac{1}{\frac{1}{30} - \frac{1}{10}} = -15 \text{ cm} .$$

Eq. 35-6 yields $m = -(-15)/10 = +1.5$. Therefore, the image is virtual ($i < 0$) and upright ($m > 0$). The ray diagram would be similar to Fig. 35-14(b) in the textbook.

(f) Eq. 35-10 yields $f = \frac{1}{n-1}(1/r_1 - 1/r_2)^{-1} = -30$ cm. Since $f < 0$, this must be a diverging ("D") lens. From Eq. 35-9, we obtain

$$i = \frac{1}{\frac{1}{f} - \frac{1}{p}} = \frac{1}{\frac{1}{-30} - \frac{1}{10}} = -7.5 \text{ cm} .$$

Eq. 35-6 yields $m = -(-7.5)/10 = +0.75$. Therefore, the image is virtual ($i < 0$) and upright ($m > 0$). The ray diagram would be similar to Fig. 35-14(c) in the textbook.