Curved Mirror Questions

1. On a separate sheet of paper, solve for the unknown values / properties in the table:

<table>
<thead>
<tr>
<th>Mirror</th>
<th>f (cm)</th>
<th>C (cm)</th>
<th>$d_o$ (cm)</th>
<th>$d_i$ (cm)</th>
<th>M</th>
<th>Real or Virtual</th>
<th>Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concave</td>
<td>+10</td>
<td>+20</td>
<td>30</td>
<td>+15</td>
<td>-0.5</td>
<td>Real</td>
<td>Inverted</td>
</tr>
<tr>
<td>Concave</td>
<td>+15</td>
<td>+30</td>
<td>30</td>
<td>+30</td>
<td>-1.0</td>
<td>Real</td>
<td>Inverted</td>
</tr>
<tr>
<td>Convex</td>
<td>-15</td>
<td>-30</td>
<td>30</td>
<td>-10</td>
<td>0.33</td>
<td>Virtual</td>
<td>Upright</td>
</tr>
<tr>
<td>Convex</td>
<td>-13</td>
<td>-26</td>
<td>16</td>
<td>-7.17</td>
<td>0.45</td>
<td>Virtual</td>
<td>Upright</td>
</tr>
<tr>
<td>Concave</td>
<td>+30</td>
<td>+60</td>
<td>30</td>
<td>0</td>
<td>n/a</td>
<td>no image</td>
<td>n/a</td>
</tr>
</tbody>
</table>

For the following problems, use the GRASS method (Given, Required, Analysis, Substitution, and Solution).

2. A thumb of height 8.0 cm is held in front of a concave mirror of focal length 10.0 cm. The image is formed 12.0 cm from the vertex of the mirror. Find:
   a. The position of the object.
   b. The magnification
   c. The size of the image
   d. The type and orientation of the image

   -0.2 x
   -1.6 cm
   Real, inverted, smaller

3. In a physics lab, a candle is placed in front of a converging mirror with a focal length of 15 cm. If the candle sits at the centre of curvature (C) and has a flame 1.5 cm tall, find:
   a. The distance to the object
   b. The image position
   c. The magnification
   d. The image size
   e. The type and orientation of the image

   30 cm
   30 cm
   -1.0 x
   -1.5 cm
   Real, inverted, same size

4. A converging shaving/makeup mirror has a focal length of 17 cm. If the person's face is 12 cm from the vertex of the mirror and is 22 cm long, find:
   a. The image position
   b. The magnification
   c. The image size
   d. The type and orientation of the image

   -40.8 cm (or 40.8 cm behind mirror)
   3.4 x
   74.8 cm
   Virtual, upright, bigger
5. For a concave mirror of focal length 20 cm, where must you place the object so that no image can be seen? Prove with a diagram and using the mirror equation.

6. The Palomar Telescope has a focal length of 18 m. If the diameter of the Sun is $1.39 \times 10^9$ m and its distance to the Earth is $1.49 \times 10^{11}$ m, how large is the image of the Sun? $-0.17 \text{ m (hi)}$ \text{Hint: Solve for } d_i, \text{ then } M, \text{ then you can solve for } h_i.

7. Looking at the back of a spoon you can see an image of your face. If the focal length of the spoon is 5.5 cm, and your face is 10.0 cm away and 22 cm long:
   a. What type of mirror is the spoon? \textit{convex (back of spoon)}
   b. What sign should the focal length have (positive or negative)?
   c. What is the position of the image? $-3.55 \text{ cm}$
   d. What is the magnification of the image? $+0.35 x$
   e. What is the size of the image? $7.8 \text{ cm}$ \textit{virtual, upright, smaller}
   f. What is the orientation of the image?

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![Diagram of a concave mirror with reflected rays parallel]