Exercices de physique - Corrigé de la série n° 5

Cours 3PYDF06-07

1. Lentille convergente.

(1) On trouve

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{p'} \;\Rightarrow\; p' = \frac{fp}{p-f} = \frac{20 \cdot 50}{50-20} \approx 33.3 \text{ cm}$$

Sur la calculatrice, il suffit de taper

$$\boxed{20} \rightarrow \boxed{x^{-1}} \rightarrow \boxed{-} \rightarrow \boxed{50} \rightarrow \boxed{x^{-1}} \rightarrow \boxed{\texttt{enter}} \rightarrow \boxed{x^{-1}} \rightarrow \boxed{\texttt{enter}}$$

(2) On trouve

$$\frac{h'}{h} = \frac{p'}{p} = \frac{\frac{100}{3}}{50} = \frac{2}{3}$$

2. Une lentille convergente.

(1) On trouve

p [cm]	10'000	1'000	100	18	12	6.1	3
p' [cm]	6.0036	6.0362	6.3829	9	12	366	-6

(2) On trouve que $p' \approx f$ quand $p \gg f$.

3. Photographie.

On trouve

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{p'} \;\Rightarrow\; p' = \frac{fp}{p-f}$$

De plus,

$$\frac{h'}{h} = \frac{p'}{p} \;\Rightarrow\; h' = h\frac{p'}{p} = h\frac{\frac{fp}{p-f}}{p} = \frac{fh}{p-f} = \frac{0.024 \cdot 20}{10-0.024} \approx 4.81 \text{ cm}$$

4. Un appareil photo.

On trouve

$$\frac{p}{p'} = \frac{h}{h'} = \frac{180}{3.6} = 50 \;\Rightarrow\; p' = \frac{p}{50} \;\Rightarrow\; \frac{1}{f} = \frac{1}{p} + \frac{1}{p'} = \frac{1}{p}\left(1 + \frac{1}{\frac{1}{50}}\right) \;\Rightarrow\; p = f\,(1+50) = 2.55 \text{ m}$$

5. Image nette.

(1) On trouve

$$4 = \frac{h'}{h} = \frac{p'}{p} \;\Rightarrow\; p' = 4p \;\Rightarrow\; \frac{1}{f} = \frac{1}{p} + \frac{1}{p'} = \frac{1}{p}\left(1 + \frac{1}{4}\right) \;\Rightarrow\; p = f\left(1 + \frac{1}{4}\right) = 16 \cdot \frac{5}{4} = 20 \text{ cm}$$

(2) On trouve

$$-4 = \frac{h'}{h} = \frac{p'}{p} \;\Rightarrow\; p' = -4p \;\Rightarrow\; \frac{1}{f} = \frac{1}{p} + \frac{1}{p'} = \frac{1}{p}\left(1 - \frac{1}{4}\right) \;\Rightarrow\; p = f\left(1 - \frac{1}{4}\right) = 16 \cdot \frac{3}{4} = 12 \text{ cm}$$

6. Une bougie.

On trouve

$$d = p + p' \text{ et } \frac{1}{f} = \frac{1}{p} + \frac{1}{p'} \;\Rightarrow\; f = \frac{pp'}{p'+p} = \frac{p(d-p)}{d} \;\Rightarrow\; p^2 - dp + fd = 0$$

$$\Rightarrow\; p_\pm = \frac{d \pm \sqrt{d^2 - 4fd}}{2} = \frac{d \pm \sqrt{d(d-4f)}}{2} = \frac{200 \pm \sqrt{200(200 - 4\cdot 32)}}{2} = \begin{cases} 160 \text{ cm} \\ 40 \text{ cm} \end{cases}$$

7. Lentille divergente.

(1) On trouve

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{p'} \;\Rightarrow\; p' = \frac{fp}{p-f} = \frac{-20\cdot 50}{50-(-20)} = \frac{-100}{7} \approx -14.3 \text{ cm}$$

Sur la calculatrice, il suffit de taper

$\boxed{-20} \to \boxed{x^{-1}} \to \boxed{-} \to \boxed{50} \to \boxed{x^{-1}} \to \boxed{\texttt{enter}} \to \boxed{x^{-1}} \to \boxed{\texttt{enter}}$

(2) On trouve

$$\frac{h'}{h} = \frac{p'}{p} = \frac{-\frac{100}{7}}{50} = -\frac{2}{7}$$

8. Une lentille divergente.

On trouve

$$-2 = \frac{h}{h'} = \frac{p}{p'} \;\Rightarrow\; p' = \frac{p}{-2} \text{ et } \frac{1}{f} = \frac{1}{p} + \frac{1}{p'} = \frac{1}{p}\left(1 - \frac{1}{\frac{1}{2}}\right) \;\Rightarrow\; p = f(1-2) = -f = 20 \text{ cm}$$