# Buying a Telescope!


OK…So those wonderful pictures of planets, star clusters and galaxies have got your curiosity on fire. You want to have your own telescope so that you can see the universe for yourself! All you have to do is spend a few minutes on the Internet and you will see a bewildering number of choices for telescopes you can buy. Some are pretty inexpensive and cost less than $70.00, but others can cost $500.00 or more. How do you decide which one is right for you?

Remember, the bigger the objective lens or mirror, the fainter you can see stars in the sky. The longer the focal length, the higher will be the magnification. The only limit to either of these is that you should not use magnifications higher than 50x the diameter of the objective, or 2 times its diameter in millimeters. Higher magnifications only make images look worse!

| Type | Objective (cm) | Focal Length (millimeters) | Maximum Magnification | Cost |
|---|---|---|---|---|
| Reflector | 7.6 | 300 | | $64.95 |
| Refractor | 6.0 | 700 | | $54.95 |
| Refractor | 8.9 | 910 | | $300.00 |
| Reflector | 11.4 | 900 | | $129.95 |
| Reflector | 15.2 | 610 | | $319.95 |
| Refractor | 10.0 | 900 | | $749.95 |
| Reflector | 20.3 | 1000 | | $699.95 |
| Refractor | 15.2 | 1219 | | $1,199.00 |
| Reflector | 50.8 | 2032 | | $4,400.00 |

**Problem 1** – You have a set of eyepieces with focal lengths of 2mm, 4mm and 28mm. If

$$\text{magnification} = \frac{\text{telescope focal length}}{\text{eyepiece focal length}}$$

would you be able to use all of these eyepieces with the telescopes in the table above?

**Problem 2** - In terms of cost per objective area, which type of telescopes seem to be the best value: reflectors or refractors?

**Problem 3** – About how much would you expect to pay for a 50.8-cm refractor?

| Type | Objective (cm) | Focal Length (millimeters) | Maximum Magnification | Cost | Cost per area |
|---|---|---|---|---|---|
| Reflector | 7.6 | 300 | 152x | $64.95 | 1.4 |
| Refractor | 6.0 | 700 | 120x | $54.95 | 1.9 |
| Refractor | 8.9 | 910 | 178x | $300.00 | 4.7 |
| Reflector | 11.4 | 900 | 228x | $129.95 | 1.3 |
| Reflector | 15.2 | 610 | 304x | $319.95 | 1.8 |
| Refractor | 10.0 | 900 | 200x | $749.95 | 9.6 |
| Reflector | 20.3 | 1000 | 406x | $699.95 | 2.2 |
| Refractor | 15.2 | 1219 | 304x | $1,199.00 | 6.6 |
| Reflector | 50.8 | 2032 | 1016x | $4,400.00 | 2.2 |

**Problem 1** – You have a set of eyepieces with focal lengths of 2mm, 4mm and 28mm. If

$$\text{magnification} = \frac{\text{telescope focal length}}{\text{eyepiece focal length}}$$

would you be able to use all of these eyepieces with the telescopes in the table above?

Answer: The limit would be set by the 2mm eyepiece. For the telescope focal lengths in the table, this eyepiece could not be used with the telescopes shaded in yellow in the table, Telescopes 2, 3, 4, 6, 7 and 8. The 4mm would not be used on telescopes 2, 3, 4, and 6.

**Problem 2** - In terms of cost per objective area, which type of telescopes seem to be the best value: reflectors or refractors?

Answer: You can get a reflector with a larger area than you can a refractor. Refractors are more expensive per unit area. From the table, reflectors cost 1.3 to 2.2 dollars per square centimeter, while refractors cost 1.9 to 9.6 dollars per square centimeter.

**Problem 3** – About how much would you expect to pay for a 50.8-cm refractor?

Answer: A 15.2 cm refractor costs about 6.6 dollars per square centimeter, so a 50.8-cm refractor would cost $\pi (50.8/2)^2 \times 6.6 =$ **$13,374.**