

Splitting light, coloured filters, lenses and the eye

Grade 8 science (Year 9 · Class 8) · Lab answers

Model answers use the sample measurements in the results tables. Your own numbers will differ slightly, but the pattern should be the same: the closer the object, the further away and larger the image, until the object reaches the focal length.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS4-2

Question 1 Mean focal length

Mean = $(10.1 + 10.3 + 10.0) \div 3 = 30.4 \div 3 = 10.13$ cm, so the focal length is **10.1 cm**.

Question 2 Magnification of one image

Using heights: $M = 0.7 \div 2.0 = 0.35$. Using distances: $M = 13.5 \div 40.0 = 0.34$. The values agree: **$M \approx 0.35$** (a diminished image).

Question 3 Larger images

$u = 15.0$ cm: $M = 3.9 \div 2.0 = 1.95$, and $v \div u = 29.5 \div 15.0 = 1.97$. $u = 12.0$ cm: $M = 9.6 \div 2.0 = 4.8$, and $v \div u = 58.0 \div 12.0 = 4.83$. The values are **about 1.95 and 4.8**.

Question 4 Describing the trend

As u gets smaller, v gets larger (13.5 cm to 58.0 cm) and the image gets larger (0.7 cm to 9.6 cm). The image is always inverted. **The closer the object, the further away and larger the image.**

Question 5 Image at 2F

At $u = 20.0$ cm the image is the same size, which happens at 2F. So $f = 20.0 \div 2 = \mathbf{10.0}$ cm, which agrees with 10.1 cm to within the uncertainty.

Question 6 Uncertainty

For $v = 13.5$ cm: $1.0 \div 13.5 \times 100 = 7.4$ %. For $v = 58.0$ cm: $1.0 \div 58.0 \times 100 = 1.7$ %. The reading at $u = 12.0$ cm is **more reliable (1.7 % against 7.4 %)**.

Question 7 Object inside the focal length

At $u = 8.0$ cm the object is closer than F , so the rays leave the lens still spreading apart and never meet. The image is virtual. Looking through the lens you see an **upright, larger image**, like a magnifying glass.

Question 8 Sharper focus readings

Any two of: darken the room so the sharpest image is clear; move the screen back and forth and take the middle of the sharp range; repeat each reading and average; measure from the centre of the lens; keep the screen upright with a set square. **Darken the room and average repeats** are good examples.