Discussion Part A

Technique 4 – And General Note

The “accepted” value for the focal length (23cm) is assumed to be the value measured by the spherometer. While the instrument can be very precise, a 10% uncertainty was determined after comparing several readings and error propagation. Because the margin of error for the “accepted” value is large, it’s no surprise that the percent discrepancies for the other techniques were often greater than their respective margins of error. This is a quick and convenient technique which can be used to find the focal lengths of both concave and convex mirrors.

Technique 1

A “quick and dirty” method, easy to execute but yielded terrible results. The focal length was found to be 6cm with a 67% uncertainty. The percent difference from the theoretical value is 74% which is not within the error margin. This technique could also be used to find the focal length of a convex mirror, the only difference being that the image would be virtual and upright.

Technique 2

This has the potential to be a highly accurate method, however, it requires special equipment and careful setup. Great care should be taken to ensure that the two beams are parallel with each other and with the mirror’s principal axis. The focal length was found to be 19.5cm with a 3% uncertainty. The percent difference from the theoretical value is 16% which is not within the error margin. This method relies upon the convergence of laser beams and would, therefore, not be suitable for convex mirrors which would diverge the laser beams.

Technique 3

An accurate method, not as precise as technique 2 but requires less special equipment. The focal length was found to be 21cm with a 10% margin of error. The percent difference from the theoretical value is 9% which is not within the error margin. This method relies upon the creation of a real image and would, therefore, not be suitable for convex mirrors which only produce virtual images.

Discussion Part B

General Note

Due to the small size of the lens, no focal length “accepted” value could be found with the spherometer. As such, there are no percent discrepancies for this portion of the experiment.

Technique 1

Like technique 2 for the concave mirror, this similar method has the potential for very accurate results. A fair amount of effort is needed to properly setup the lasers, ensuring that they are parallel with each other and with the principal axis of the lens. The focal length was found to be 26cm with a 2% uncertainty. This method relies upon the convergence of laser beams and would, therefore, not be suitable for a diverging lens which would diverge the beams.

Technique 2

A relatively easy experiment to setup with minimal equipment and decent results. This technique was overall the most convenient of those done for the converging lens. The light rays passing through the lens were assumed “close” to parallel, but not precisely. Perhaps this experiment could be more accurate if the Sun were used as the distant light source instead. The focal length was found to be 21cm with a 3% uncertainty. This method relies upon the convergence of parallel light rays and would, therefore, not be suitable for a diverging lens which would diverge the rays.

Technique 3

An accurate method, not as precise as technique 1 but requires less special equipment. The focal length was found to be 19cm with a 6% uncertainty. This method relies upon the creation of a real image and would, therefore, not be suitable for diverging lenses which would produce a virtual image on the same side as the object.