

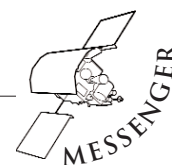


ANSWER KEY

Sample answers to Student Worksheet Questions:

Student Worksheet 1

1. The goggles made the vertical FOV a lot smaller.
2. The goggles did not significantly reduce the side-to-side [horizontal] FOV. Slits and construction styles may cause answers to vary.
3. Advantages include increased comfort level while looking at bright areas, ability to look longer in bright areas, improved visibility of specific objects.
4. Disadvantages include problems of seeing nearby objects, the need to move one's head or eyes more often to see potential threats—both stationary such as low branches, trenches or sharp objects in your path, and moving things, such as a hungry polar bear lumbering towards you.
5. They should not, since the goggles work by reducing the amount of light entering the viewer's eyes, and light hitting the opaque goggles does not go through whether they are covered by reflective material or not. (Note that reflective material could help keep snow goggles from overheating by reflecting much of the sunlight striking them instead of having it absorbed, but in the cold, arctic springtime, overheating is not usually a big problem.)
6. The goggles would work well, since they reduce the amount of sunlight and glare entering the eyes from above and below while allowing you to scan your environment horizontally without moving your head.
7. Students may want to make the goggles from sturdier material, reduce or increase slit size, etc. Observe the goggles that students design.
8. Students may wish to use the 5-mm pattern to reduce the amount of light entering their eyes, or the 7-mm pattern to increase their field of view. This is the correct reasoning for choosing between the slit sizes, but which size the students choose to use depends on the individual person's preference, and there is no "correct" answer to this question.





Student Challenge Worksheet 1

Group questions

1. Answers will vary depending on exactly how the experiment was done and the student's individual FOV.
2. Answers on charts will vary corresponding to the measurements.

Individual questions

1. The reduction factor is expected to be roughly 3-4. This means that your unprotected eyes receive 3-4 times more light than when you wear the protective snow goggles. Students' answers may vary because of measurement errors, differing visions among students, etc.

Student Challenge Worksheet 2

MESSENGER Mission Designers' solutions to:

Situation One: 70% of the area of the spacecraft's two solar panels is covered with mirrors, while only 30% has actual solar cells generating energy. In other words, we reduce the unwanted light on MESSENGER by reflecting much of it away and increasing the area from which to radiate away the absorbed excess sunlight.

Situation Two: MESSENGER's instruments use baffles—basically fences that limit the amount of sunlight entering the instrument detectors. This is actually a solution very similar to the snow goggles!

