Name: _____ Date: _____

The Mirror Maker Who Waits for Glass to Cool

Circle group

Many big telescopes gather light with a mirror shaped like a shallow bowl. The mirror must be very smooth. Its surface can be off by only a tiny bit of the width of a light wave. That is much thinner than a hair. Making a surface this perfect is the work of an optician. It takes patience as much as skill.

The job starts with a thick disk of glass. The optician grinds it against another disk. Wet gritty powder goes between them. The grinding wears the glass into a gentle curve. Then the optician uses finer and finer powders. Each stage takes away the scratches from the stage before.

Next comes polishing. It makes the surface shine. At each step, the optician stops to test the mirror. A light is shone on it, and the optician studies the reflection. If a spot is too high or too low, the next round of work goes right to that spot.

But there is a catch. Glass changes shape when it gets warm, even a little. A person's hands or a warm room can make the mirror swell for a while. That gives a false test. So the optician waits for the glass to cool to room temperature. Only then does the optician trust the test. A mirror can take weeks or months to finish. One hurried step can undo the work.

Questions

1. What shape does a telescope mirror have?

_____

_____

2. What goes between the glass disks when grinding?

_____

_____

3. Why does the optician use finer powders?

_____

_____

4. How does the optician test the mirror?

_____

_____

5. Why must the optician wait for the glass to cool?

_____

_____

6. Why does patience matter as much as skill?

_____

_____

Words to know

optician: a person who makes lenses and mirrors
grinds: rubs hard against something to wear it down
gritty: full of tiny rough bits like sand
polishing: rubbing a surface until it is smooth and shiny
swell: to grow a little larger

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

The Mirror Maker Who Waits for Glass to Cool

Triangle group

Many large telescopes gather light with a mirror shaped like a shallow bowl. The mirror must be extremely smooth. Its surface can be off by only a tiny fraction of the width of a light wave, which is far thinner than a human hair. Making a surface that perfect is the work of an optician, and it takes patience as much as skill.

The job begins with a thick disk of glass. The optician grinds it against another disk, using wet gritty powder between them. The grinding wears the glass into a gentle curve. As the work goes on, the optician switches to finer and finer powders, and each stage removes the scratches left by the stage before.

Polishing comes next, and it brings the surface to a shine. At every step, the optician stops to test the mirror by shining a light on it and studying the reflection. If a spot is too high or too low, the next round of work is aimed right at that spot.

There is a catch. Glass changes shape when it warms up, even a little. A person's hands or a warm room can make the mirror swell for a moment and give a false test. So the optician waits for the glass to settle to room temperature before trusting a measurement. A mirror can take weeks or months to finish, and a single hurried step can undo the progress.

Questions

1. What shape does a telescope mirror have?

_____

_____

2. What does the optician use between the two glass disks when grinding?

_____

_____

3. Why does the optician switch to finer powders?

_____

_____

4. How does the optician test the mirror?

_____

_____

5. Why must the optician wait for the glass to reach room temperature?

_____

_____

6. Why does the passage say patience matters as much as skill?

_____

_____

Words to know

optician: a person who makes lenses and mirrors
grinds: rubs hard against something to wear it down
gritty: full of tiny rough bits like sand
polishing: rubbing a surface until it is smooth and shiny
swell: to grow a little larger

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

The Mirror Maker Who Waits for Glass to Cool

Square group

Many large telescopes collect light with a mirror that is shaped like a shallow bowl. The mirror must be extraordinarily smooth: its surface can deviate by only a tiny fraction of the width of a light wave, which is far thinner than a human hair. Producing a surface that flawless is the work of an optician, and it demands patience just as much as skill.

The job begins with a thick disk of glass. The optician grinds it against a second disk, using wet gritty powder between the two. The grinding gradually wears the glass into a gentle curve. As the work progresses, the optician switches to progressively finer powders, and each stage erases the scratches left behind by the stage before it.

Polishing follows, and it brings the surface to a brilliant shine. At every step, the optician pauses to test the mirror by directing a light onto it and carefully studying the reflection. If a spot is too high or too low, the next round of work is concentrated precisely on that spot.

There is, however, an unexpected complication. Glass changes shape when it warms up, even slightly. A person's hands or a warm room can cause the mirror to swell for a time and produce a misleading test. Therefore the optician waits for the glass to settle to room temperature before trusting any measurement. A mirror may take weeks or even months to complete, and a single hurried step can undo all the progress.

Questions

1. What shape does the mirror of a large telescope have?

_____

_____

2. What does the optician place between the two glass disks while grinding?

_____

_____

3. Why does the optician switch to progressively finer powders?

_____

_____

4. How does the optician test the mirror at each step?

_____

_____

5. Why must the optician wait for the glass to settle to room temperature?

_____

_____

6. Why does the passage say the work demands patience as much as skill?

_____

_____

Words to know

optician: a person who makes lenses and mirrors
grinds: rubs hard against something to wear it down
gritty: full of tiny rough bits like sand
polishing: rubbing a surface until it is smooth and shiny
swell: to grow a little larger

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: The Mirror Maker Who Waits for Glass to Cool

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: The Mirror Maker Who Waits for Glass to Cool

Easier · 230 words · Flesch-Kincaid grade 3.6

1. A shallow bowl shape with a gentle curve.
2. Wet gritty powder.
3. Each finer stage takes away the scratches from the stage before.
4. By shining a light on it and studying the reflection.
5. Warm glass changes shape a little, which gives a false test.
6. The work takes weeks or months, and one hurried step can undo it.

Triangle: The Mirror Maker Who Waits for Glass to Cool

This passage · 237 words · Flesch-Kincaid grade 6.2

1. A shallow bowl shape with a gentle curve.
2. Wet gritty powder.
3. Each finer stage removes the scratches left by the stage before.
4. By shining a light on it and studying the reflection.
5. Warm glass changes shape slightly, which would give a false test.
6. The work takes weeks or months, and a hurried step can undo progress.

Square: The Mirror Maker Who Waits for Glass to Cool

Harder · 247 words · Flesch-Kincaid grade 8.7

1. A shallow bowl shape with a gentle curve.
2. Wet gritty powder.
3. Each stage erases the scratches left behind by the stage before it.
4. By directing a light onto it and carefully studying the reflection.
5. Warm glass changes shape slightly, which would produce a misleading test.
6. It takes weeks or months, and one hurried step can undo all the progress.