Negative-Space Planet Silhouettes: Drawing by Shading the Surround

Original tasks 1, 2, 3 / complete keys

Task 1

An unringed planet has a radius of 25 mm. You add one moon whose center is 40 mm from the planet center and whose radius is 5 mm. What is the gap between the planet limb and the moon limb?

Answer: The planet limb is at 25 mm from the center. The moon limb nearest the planet is at 40 - 5 = 35 mm from the planet center. The gap is 35 - 25 = 10 mm.

Reason: Subtract the planet radius from the moon's near limb distance. The moon's near limb is its center distance minus its radius.

Check: Measure the planet radius and the moon center distance on your drawing; confirm the near limb distance and the 10 mm gap with a ruler.

Task 2

A ringed planet has a radius of 30 mm. The inner ring edge is 3 mm from the limb, and the ring band is 10 mm wide. A moon sits 5 mm outside the outer ring edge. What is the moon's minimum distance from the planet center if the moon radius is 4 mm?

Answer: Inner ring edge: 30 + 3 = 33 mm. Outer ring edge: 33 + 10 = 43 mm. Moon near limb: 43 + 5 = 48 mm. Moon center: 48 + 4 = 52 mm from the planet center.

Reason: Add the gap and band widths to the planet radius to find the outer ring edge, then add the moon gap and moon radius to find the center distance.

Check: Measure each segment on the drawing: planet radius, gap, band, moon gap, and moon radius; sum them and compare with the calculated 52 mm.

Task 3

You are drawing a ringed planet with a radius of 18 mm. You want the outer ring edge at 28 mm from the center and a gap of 2 mm between the planet limb and the inner ring edge. What is the ring band width?

Answer: Inner ring edge: 18 + 2 = 20 mm. Ring band width: 28 - 20 = 8 mm.

Reason: Locate the inner ring edge by adding the gap to the planet radius, then subtract that from the outer ring edge.

Check: Measure the inner and outer ring edges on the drawing and confirm the difference is 8 mm.

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Original tasks 4 / complete keys

Task 4

A planet has a radius of 22 mm. You draw two moons: moon A with radius 3 mm at 35 mm from the planet center, and moon B with radius 4 mm at 45 mm from the planet center. What are the gaps between the planet limb and each moon's near limb, and which moon is closer to the planet?

Answer: Moon A near limb: 35 - 3 = 32 mm; gap: 32 - 22 = 10 mm. Moon B near limb: 45 - 4 = 41 mm; gap: 41 - 22 = 19 mm. Moon A is closer to the planet.

Reason: For each moon, subtract its radius from its center distance to find the near limb, then subtract the planet radius to find the gap. Compare the gaps to determine which moon is closer.

Check: Measure both moon center distances and radii on the drawing; confirm the near limbs and gaps, and check that moon A's gap is smaller.

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Source rubric / reflection

- [ ] Planet body is unshaded and its outline is clear.
- [ ] Ring bands, if present, are unshaded and separated from the body by a visible gap.
- [ ] Moons, if present, are unshaded and separated by visible gaps.
- [ ] Surround shading is even and does not cross negative-space edges.
- [ ] Gap widths are consistent and checkable by measurement.
- [ ] Valid stylistic alternatives such as ring tilt, moon count, and shading texture are accepted.

Reflection: What did you check, what did you change, and what will you try next?