Draw a Mars Disk with Surface Feature Shading

Original tasks 1, 2, 3 / complete keys

Task 1

A circle has a measured diameter of 100 mm. You choose a cap depth of 10 mm and a limb band of 5 mm. State the radius and confirm each proportion by division.

Answer: Radius is 50 mm. Cap depth 10 mm is one tenth of the diameter and one fifth of the radius. Limb band 5 mm is one twentieth of the diameter.

Reason: Divide diameter by two for radius. Divide cap depth by diameter and by radius. Divide limb band by diameter. All divisions use the same units, millimetres.

Check: Recompute each division with a calculator or by hand and confirm the results match the stated fractions.

Task 2

A disk of diameter 80 mm has a terminator drawn as a hard straight line on the left side. Describe two changes that would make the terminator read as a soft zone and explain how to check the result.

Answer: Replace the straight line with a curved boundary that follows the disk, and soften it with light hatching or blending so tone increases gradually toward the edge. Check by stepping back: the transition should be a zone, not a line, and dark features should remain visible.

Reason: A terminator on a sphere curves with the disk. A hard line reads as flat. Softening creates a gradual tonal change. The check is visual and does not require new measurements.

Check: View the drawing at arm's length and confirm no sharp line separates lit and shadowed areas.

Task 3

You have placed three dark patches but the disk looks flat. Using only the three-tone key, describe one adjustment and one check.

Answer: Add a narrow mid-tone band inside the limb, keeping it even and no wider than one twentieth of the diameter as a hypothetical guide. Check by ranking the tones: lightest at cap or gaps, mid dominant, dark limited to feature cores and shadow edge.

Reason: Flatness often comes from missing limb darkening. A narrow mid-tone band adds curvature without changing feature placement. The tone ranking confirms the key is still respected.

Check: Step back and list the lightest, middle, and darkest areas; confirm they match the key.

Draw a Mars Disk with Surface Feature Shading

Original tasks 4 / complete keys

Task 4

A circle of diameter 70 mm has a cap depth of 7 mm. A classmate says the cap is too deep because it is one fifth of the radius. Check the arithmetic and state whether the claim is correct.

Answer: Radius is 35 mm. Cap depth 7 mm is one tenth of the diameter and one fifth of the radius. The arithmetic is correct, but whether the cap is too deep is a visual judgement, not an arithmetic error.

Reason: Divide 70 by 2 to get 35. Divide 7 by 70 to get one tenth. Divide 7 by 35 to get one fifth. The claim about the fraction is right; the judgement about depth needs a visual check.

Check: Recompute the divisions and then view the drawing at arm's length to judge cap depth.

Draw a Mars Disk with Surface Feature Shading

Source rubric / reflection

- [ ] Disk is a light circle with center and vertical axis marked.
- [ ] A three-tone key is written and used consistently.
- [ ] Polar caps are curved bands inside the circle, not straight lines.
- [ ] Two or three irregular dark albedo patches are placed with light gaps.
- [ ] Limb darkening is a narrow even band that does not touch the caps.
- [ ] Terminator is softened and features remain visible within the shadow.
- [ ] Measured diameter, cap depth, and limb band are recorded and checked by division.
- [ ] Valid alternatives are accepted if the convention is stated and the geometry checks out.

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