π IN THE SKY¹⁰

ANSWER KEY

METAL MATH

Compute the approximate density of asteroid (16) Psyche.

1 **Use the formula for volume of a triaxial ellipsoid to compute the volume of Psyche.**

V = 4/3πabc

V = 4/3 π(145 km) • (122.5 km) • (85 km) ≈ 6,300,000 km³

2 **Use the formula for density to compute the approximate density of Psyche.**

D = m/V

D = (2.7 • 10¹⁹ kg) / (6.3 • 10⁶ km³) ≈ $\boxed{4.3 • 10^{12} \text{ kg/km}^3}$

Does the density of Psyche support the observations indicating the presence of metal?

1 **Convert the units to match the density units given.**

4.3 • 10¹² kg/km³ • (1 km³ / 10⁹ m³) = 4.3 • 10³ kg/m³

= 4,300 kg/m³

This is higher density than rock, so Psyche must contain some metal.
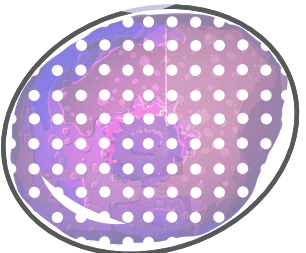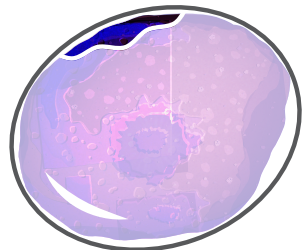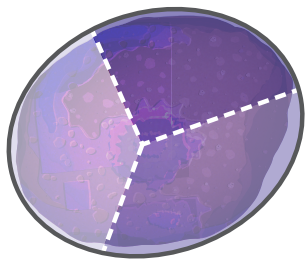
```
analyzing asteroid makeup ...
comparing density to ...
    ice: 917 kg/m^3
  water: 997 kg/m^3
   rock: 1600 — 3500 kg/m^3
  metal: 534 — 22590 kg/m^3
result: match found for metal
```