

$$2. \int_{\theta=0}^{2\pi} \int_{\phi=0}^{\frac{\pi}{2}} \int_{\rho=0}^{\sin\phi} (\rho^3 \cos\phi) d\rho d\phi d\theta$$

$$= \int_{\theta=0}^{2\pi} \int_{\phi=0}^{\frac{\pi}{2}} \left[\frac{1}{4} \rho^4 \cos\phi \right]_{\rho=0}^{\rho=\sin\phi} d\phi d\theta$$

$$= \frac{1}{4} \int_{\theta=0}^{2\pi} \int_{\phi=0}^{\frac{\pi}{2}} \cos\phi [\sin^4\phi - 0^4] d\phi d\theta$$

$$= \frac{1}{4} \int_{\theta=0}^{2\pi} \int_{\phi=0}^{\frac{\pi}{2}} \cos\phi (\sin\phi)^4 d\phi d\theta$$

$$u = \sin\phi \quad du = \cos\phi d\phi$$

$$= \frac{1}{4} \int_{\theta=0}^{2\pi} \int_{\phi=0}^{\frac{\pi}{2}} u^4 du d\theta$$

$$= \frac{1}{4} \int_{\theta=0}^{2\pi} \left[\frac{1}{5} u^5 \right]_{\phi=0}^{\phi=\frac{\pi}{2}} d\theta$$

$$= \frac{1}{4} \cdot \frac{1}{5} \int_{\theta=0}^{2\pi} [\sin^5\phi]_{\phi=0}^{\phi=\frac{\pi}{2}} d\theta$$

$$= \frac{1}{20} \int_{\theta=0}^{2\pi} [\sin^5\frac{\pi}{2} - \sin^5 0] d\theta$$

$$= \frac{1}{20} \int_{\theta=0}^{2\pi} 1 d\theta$$

$$= \frac{1}{20} [\theta]_{\theta=0}^{\theta=2\pi}$$

$$= \frac{1}{20} [2\pi - 0]$$

$$= \frac{2\pi}{20}$$

$$= \frac{\pi}{10}$$