(21) $\theta \in [0, 2\pi]$

$x^2+y^2=1$

$z^2 = 4x^2+4y^2 = 4r^2$

$r^2=1$

$z=2r \quad z\in[0,2r]$

$r=1 \quad r\in[0,1]$

$$\int_0^{2\pi}\int_0^1\int_0^{2r} r^3\cos^2\theta \, dz\, dr\, d\theta = \int_0^{2\pi}\int_0^1 2r^4\cos^2\theta \, dr\, d\theta$$

$$= \int_0^{2\pi}\cos^2\theta\, d\theta \int_0^1 2r^4\, dr = \frac{2}{5}\int_0^{2\pi}\cos^2\theta\, d\theta = \frac{2}{5}\int_0^{2\pi}\frac{1}{2}+\frac{1}{2}\cos 2\theta\, d\theta$$

$$= \frac{2}{5}\left[\frac{\theta}{2}+\frac{1}{4}\sin 2\theta\right]_0^{2\pi} = \frac{2}{5}[\pi] = \boxed{\frac{2\pi}{5}}$$

(23) $z=\sqrt{x^2+y^2} \quad z=\sqrt{2-x^2-y^2}$

$r^2 = 2-r^2 \quad \theta\in[0,2\pi]$

$2r^2=2$

$z=r \quad z=\sqrt{2-r^2}$

$r^2=1$

$r=1$

$z\in[r,\sqrt{2-r^2}]$

$r\in[0,1]$

$$\int_0^{2\pi}\int_0^1\int_r^{\sqrt{2-r^2}} r\, dz\, dr\, d\theta = \int_0^{2\pi}d\theta\int_0^1 r\left[\sqrt{2-r^2}-r^2\right]dr$$

$$= 2\pi\int_0^1 r\sqrt{2-r^2}-r^2\, dr = 2\pi\left(\int_0^1 r\sqrt{2-r^2}\,dr - \int_0^1 r^2\,dr\right) = 2\pi\left(\int_2^1 -\frac{1}{2}\sqrt{v}\,dv - \frac{1}{3}\right)$$

$v=2-r^2$

$dv=-2r$

$r=-\frac{1}{2}dv$

$$= 2\pi\left[\frac{1}{3}(2)^{3/2}-\frac{1}{3}-\frac{1}{3}\right)$$

$$= \frac{2\pi}{3}\left(2\sqrt{2}-2\right)$$

$$= \boxed{\frac{4\pi}{3}\left(\sqrt{2}-1\right)}$$