(13) $z = 1 + x + y \quad y \in [0, \sqrt{x}] \quad x \in [0,1]$

$z \in [0, 1+x+y]$

$$\int_0^1 \int_0^{\sqrt{x}} \int_1^{1+x+y} 6xy \, dz\,dy\,dx = \int_0^1 \int_0^{\sqrt{x}} 6xy + 6x^2y + 6xy^2 \, dy\,dx$$

$$= \int_0^1 \left[3xy^2 + 3x^2y^2 + 2xy^3 \right]_0^{\sqrt{x}} dx = \int_0^1 3x^2 + 3x^3 + 2x^{5/2} dx$$

$$= x^3 + \frac{3}{4}x^4 \quad \frac{4}{7}x^{7/2} \Big]_0^1 = 1 + \frac{3}{4} + \frac{4}{7} = 1 + \frac{21+16}{28} = \frac{28+37}{28} = \boxed{\frac{65}{28}}$$

(17) $x = 4y^2 + 4z^2 \quad x = 4$

$$\iint_D \left(\int_{4y^2+4z^2}^{4} x \, dx \right) dA = \iint_D \frac{x^2}{2} \Big]_{4y^2+4z^2}^{4} dA = \iint_D 8 - 8(y^2+z^2)^2 \, dA$$

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

$$= \int_0^{2\pi} \int_0^1 (8 - 8r^4)\, r\,dr\,d\theta = \int_0^{2\pi} 4r^2 - \frac{4}{3}r^6 \Big]_0^1 d\theta$$

$$= \int_0^{2\pi} 4 - \frac{4}{3} d\theta = 4 - \frac{4}{3}(2\pi) = \frac{8}{3}(2\pi) = \boxed{\frac{16\pi}{3}}$$

(19) $2x + y + z = 4 \qquad 2x + y = 4 \qquad 2x = 4$

$z = 4 - 2x - y \qquad y = 4 - 2x \qquad x = 2$

$z \in [0, 4-2x-y] \quad y \in [0, 4-2x] \quad x \in [0,2]$

$$V = \int_0^2 \int_0^{4-2x} \int_0^{4-2x-y} dz\,dy\,dx = \int_0^2 \int_0^{4-2x} 4 - 2x - y \, dy\,dx = \int_0^2 4y - 2xy - \frac{1}{2}y^2 \Big]_0^{4-2x} dx$$

$$= \int_0^2 16 - 8x - 8x + 4x^2 - \frac{1}{2}(16 - 16x + 4x^2)\, dx = \int_0^2 8 - 8x + 2x^2 dx = 8(2) - 4(1) + \frac{2}{3}(8)$$

$-8 + 8x - 2x^2$

$$= \boxed{\frac{16}{3}}$$