1504/P.426

$W = 12000$ lb
$F = 5000$ lb
$v_0 = 500$ mph
$v_f = 600$ mph

(a) $U_{net} = ?$
(b) Output h.p. = ?
(c) Altitude $h = ?$ if potential energy is increased instead of K.E.

Soln

$$F = ma = \frac{W}{g}a$$

$$\Rightarrow 5000 = \frac{12000}{32.2} \times a$$

$$\therefore a = 13.42 \text{ fps}^2$$

$$v_0 = 500 \text{ mph} = \frac{500 \times 1760 \times 3}{60 \times 60} \text{ fps} = 733.33 \text{ fps}$$

$$v_f = 600 \text{ mph} = \frac{600 \times 1760 \times 3}{60 \times 60} \text{ fps} = 880 \text{ fps}$$

$$v_f^2 = v_0^2 + 2as$$

$$\Rightarrow 880^2 = 733.33^2 + 2 \times 13.42 \times S$$

$$\therefore S = 8834.24 \text{ ft}$$

(a) $U_{net} = F.S. = 5000 \times 8834.24$ lb-ft $= \boxed{4.42 \times 10^7 \text{ ft-lb}}$ Ans.

(b) Final power output $= \frac{F v_f}{550}$ h.p. $= \frac{5000 \times 880}{550}$ h.p. $= \boxed{8000 \text{ h.p.}}$ Ans

(c) $W.h = \Delta KE = U_{net}$

$$\Rightarrow 12000 \times h = 4.42 \times 10^7$$

$$\therefore h = \boxed{3683.3 \text{ ft}} \text{ Ans.}$$