

Answers

Motion Review & Practice

1. $v_0 = 15 \text{ m/s [E]}$
 $v_f = 25 \text{ m/s [W] (-25)}$
 $t = 26 \text{ s}$

$$a) \bar{a} = \frac{v_f - v_0}{t}$$

$$\bar{a} = \frac{-25 - 15}{26}$$

$$\bar{a} = \frac{-40}{26}$$

$$\bar{a} = -1.54 \text{ m/s}^2 \text{ [E]}$$

$$b) \bar{d}_f = d_0 + v_0 t + \frac{1}{2} a t^2$$

$$\bar{d}_f = 0 + (15)(26) + \frac{1}{2} (-1.54)(26)^2$$

$$\bar{d}_f = 0 + 390 + -520.52$$

$$\bar{d}_f = -130 \text{ m [E]}$$

c) $v_f = ?$
 $a = -1.54 \text{ m/s}^2$
 $t = 15 \text{ s}$
 $v_i = 25 \text{ m/s (W) (-25)}$

$$a = \frac{v_f - v_0}{t}$$

$$-1.54 = \frac{v_f - (-25)}{15}$$

$$-23.1 = v_f + 25 - 25$$

$$-48.1 \text{ m/s [E]} = v_f$$

2. 20 m [E]
 35 m [W]
 50 m [E]
 10 m [W]
 $t = 52 \text{ s}$

$$a) v_{sp} = \frac{d}{t} = \frac{115 \text{ m}}{52 \text{ s}} = 2.21 \text{ m/s}$$

$$b) \bar{v}_{avg} = \frac{\bar{d}}{t} = \frac{25 \text{ m}}{52 \text{ s}} = 0.48 \text{ m/s [E]}$$

$$d = 20 + 35 + 50 + 10$$

$$d = 115 \text{ m}$$

$$\bar{d}_f = 20 + (-35) + (50) + (-10)$$

$$\bar{d}_f = 25 \text{ m}$$

$$3. \quad d = 250\text{m}$$

$$a = -9.81\text{m/s}^2$$

$$v_0 = 0\text{m/s}$$

$$a) \quad d_f = d_0 + v_0 t + \frac{1}{2} a t^2$$

$$0 = 250 + (0)(t) + \frac{1}{2}(-9.81)(t^2)$$

$$0 = 250 + 0 + -4.905 t^2$$

$$\frac{-250}{-4.905} = \frac{-4.905 t^2}{-4.905}$$

$$50.97 = t^2$$

$$\sqrt{50.97} = t$$

$$7.5 = t$$

$$b) \quad v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$v_f^2 = 0^2 + 2(-9.81)(-250)$$

$$v_f^2 = 0 + 4905$$

$$v_f = \sqrt{4905}$$

$$v_f = 70\text{m/s down } (-70\text{m/s up})$$

$$c) \quad v_f = ?$$

$$v_0 = 0\text{m/s}$$

$$a = -9.81\text{m/s}^2$$

$$d_0 = 250$$

$$d_f = 75$$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$v_f^2 = 0 + 2(-9.81)(75 - 250)$$

$$v_f^2 = 0 + (-19.62)(-175)$$

$$v_f^2 = +3433.50$$

$$v_f = \sqrt{3433.50}$$

$$v_f = +58.6\text{m/s [down]}$$

$$v_f = -58.6\text{m/s [up]}$$

$$\begin{aligned}
 4. \quad v_0 &= 21 \text{ m/s (up)} \\
 a &= -9.81 \text{ m/s}^2 \\
 t &= ? \\
 d_0 &= 0 \text{ m} \\
 d_f &= ? \\
 v_f &= 0 \text{ m/s}
 \end{aligned}$$

$$a) \quad a = \frac{v_f - v_0}{t}$$

$$-9.81 = \frac{0 - 21}{t}$$

$$-9.81 \cdot t = \frac{-21}{t} \cdot t$$

$$\frac{-9.81 t}{-9.81} = \frac{-21}{-9.81}$$

$$t = 2.15$$

$$b) \quad d_f = d_0 + v_0 t + \frac{1}{2} a t^2$$

$$d_f = 0 + (21)(2.1) + \frac{1}{2}(-9.81)(2.1)^2$$

$$d_f = 0 + 44.1 + (-21.63)$$

$$d_f = 22.5 \text{ m}$$

$$c) \quad v_f = ?$$

$$d_0 = 0$$

$$d_f = 15 \text{ m}$$

$$v_0 = 21 \text{ m/s}$$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$v_f^2 = (21)^2 + 2(-9.81)(15)$$

$$v_f^2 = 441 + (-294.3)$$

$$v_f^2 = 146.7$$

$$v_f = \sqrt{146.7}$$

$$v_f = \pm 12.1 \text{ m/s}$$

5. a)

$$v_0 = 215 \text{ m/s (S)}$$

$$v_f = 300 \text{ m/s (N)}$$

$$a = 5.72 \text{ m/s}^2 \text{ (N)}$$

$$t = ?$$

$$a = \frac{v_f - v_0}{t}$$

$$5.72 = \frac{300 - (-215)}{t}$$

$$5.72 \cdot t = \frac{515}{t} \cdot t$$

$$5.72 t = 515$$

$$t = \frac{515}{5.72}$$

$$t = 90.05$$

$$b) v_0 = 215 \text{ m/s (S) } (-215)$$

$$v_f = 300 \text{ m/s (N)}$$

$$a = 5.72 \text{ m/s}^2$$

$$t = 90.05$$

$$d_0 = 0$$

$$d_f = ?$$

$$d_f = d_0 + v_0 t + \frac{1}{2} a t^2$$

$$d_f = 0 + (-215)(90) + \frac{1}{2}(5.72)(90)^2$$

$$d_f = -19350 + 23166$$

$$d_f = 3816 \text{ m}$$

c) distance travelled total

distance south

↓ 215 m/s (S)

$$a = 5.72 \text{ m/s}^2$$
$$d_0 = 0$$
$$v_0 = 0$$
$$v_f = -215$$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$
$$(-215)^2 = 0 + 2(5.72)(d_f - 0)$$
$$\frac{46225}{11.44} = \frac{(11.44)(d_f)}{11.44}$$
$$4041 \text{ m} = d_f$$

distance North

$$a = 5.72$$

$$d_0 = 0$$

$$v_0 = 0$$

$$v_f = 300$$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$
$$(300)^2 = 0^2 + 2(5.72)(d_f - 0)$$
$$\frac{90000}{11.44} = \frac{(11.44)(d_f)}{11.44}$$
$$7867 \text{ m} = d_f$$

$$\text{total} = 4041 + 7867$$

$$\text{total} = 11908 \text{ m}$$

distance
does
not have
direction

6a) $v_0 = 250 \text{ m/s [E]}$
 $v_f = 400 \text{ m/s [W]}$
 $t = 12 \text{ s}$
 $a = ?$

$$a = \frac{v_f - v_0}{t}$$

$$a = \frac{-400 - 250}{12}$$

$$a = \frac{-650}{12}$$

$$a = -54.2 \text{ m/s}^2 \text{ [E]}$$

b) $a = -54.2 \text{ m/s}^2$
 $v_f = 400 \text{ m/s}$
 $v_0 = 250 \text{ m/s}$
 $t = 12 \text{ s}$
 $d_0 = 0$
 $d_f = ?$

$$d_f = d_0 + v_0 t + \frac{1}{2} a t^2$$

$$d_f = 0 + (250)(12) + \frac{1}{2}(-54.2)(12)^2$$

$$d_f = 3000 + -3902.4$$

$$d_f = -902 \text{ m}$$

c) distance travelled

distance south

$$a = -54.2$$

$$d_0 = 0$$

$$d_f = ?$$

$$v_0 = 0$$

$$v_f = -400$$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$(-400)^2 = 0^2 + 2(-54.2)(d_f - 0)$$

$$160000 = 0 + (-108.4)(d_f)$$

$$\frac{160000}{-108.4} = \frac{-108.4 d_f}{-108.4}$$

$$-1476.57 = d_f$$

$$+1476 \text{ m} = d_f$$

distance north

$$a = -54.2$$

$$d_0 = 0$$

$$d_f = ?$$

$$v_0 = 0$$

$$v_f = 250$$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$(250)^2 = 0 + 2(-54.2)(d_f - 0)$$

$$62500 = (-108.4)(d_f)$$

$$\frac{62500}{-108.4} = \frac{-108.4 d_f}{-108.4}$$

$$-576.57 = d_f$$

$$\text{total} = -1476 + -576.57$$

$$= 2052 \text{ m}$$

remember distance is not a vector and doesn't have direction

$\uparrow 250\text{m}$
 $Ta v_0 = 75\text{m/s (up)}$
 $a = -9.81\text{m/s}^2$
 $d_0 = 250\text{m}$
 $d_f = ?$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$0^2 = (75)^2 + 2(-9.81)(d_f - 250)$$

$$0 = 5625 + (-19.62)(d_f - 250)$$

$$0 = 5625 + (-19.62d_f) + 4905$$

$$0 = 10530 + -19.62d_f$$

$$\frac{-10530}{-19.62} = \frac{-19.62d_f}{-19.62}$$

$$537\text{m} = d_f$$

b) $d_f = 0$
 $d_0 = 250$

$$v_f^2 = v_0^2 + 2a(d_f - d_0)$$

$$v_f^2 = (75)^2 + 2(-9.81)(0 - 250)$$

$$v_f^2 = 5625 + (-19.62)(-250)$$

$$v_f^2 = 5625 + 4905$$

$$v_f^2 = 10530$$

$$v_f = \sqrt{10530}$$

$$v_f = -103\text{m/s}$$

c) $d_f = 250$
 $d_0 = 0$
 $v_0 = 75$
 $v_f = -103$
 $a = -9.81$

$$a = \frac{v_f - v_0}{t}$$

$$-9.81 = \frac{-103 - 75}{t}$$

$$-9.81t = \frac{-178}{-9.81}$$

$$t = 18.15$$