Solutions to Conceptual Physics Review (Chapt. 1+2)

① $1.609\,km = 1\,mile$ (see Appendix A, p.645)

$$\frac{100\,km}{hr} \times \frac{1\,mile}{1.609\,km} = 62.2\,mi/hr$$ so NO, not speeding

② a) $a = \frac{\Delta V}{t}$ $\quad a = \frac{10\,mi/h - 0\,mi/h}{1\,s}$ $\quad \boxed{a = 10\,mi/h \cdot s}$

b) $V_f = at$ $\quad V_f = \frac{10\,mi}{hr \cdot sec} \times 10\,sec$ $\quad \boxed{V_f = 100\,mi/hr}$

c) $d = \bar{V} t$, $\quad \bar{V} = \frac{V_0 + V_f}{2}$ $\quad \bar{V} = \frac{0 + 100\,mi/h}{2}$ $\quad \bar{V} = 50\,mi/hr$

$\rightarrow d = 50\,mi/hr \times \frac{1}{360}\,hrs = \boxed{0.14\,mi}$

(10 sec = 1/6 of a minute or 1/360th of an hour)

OR use text p.12: $50\,mi/hr = 22\,m/s$

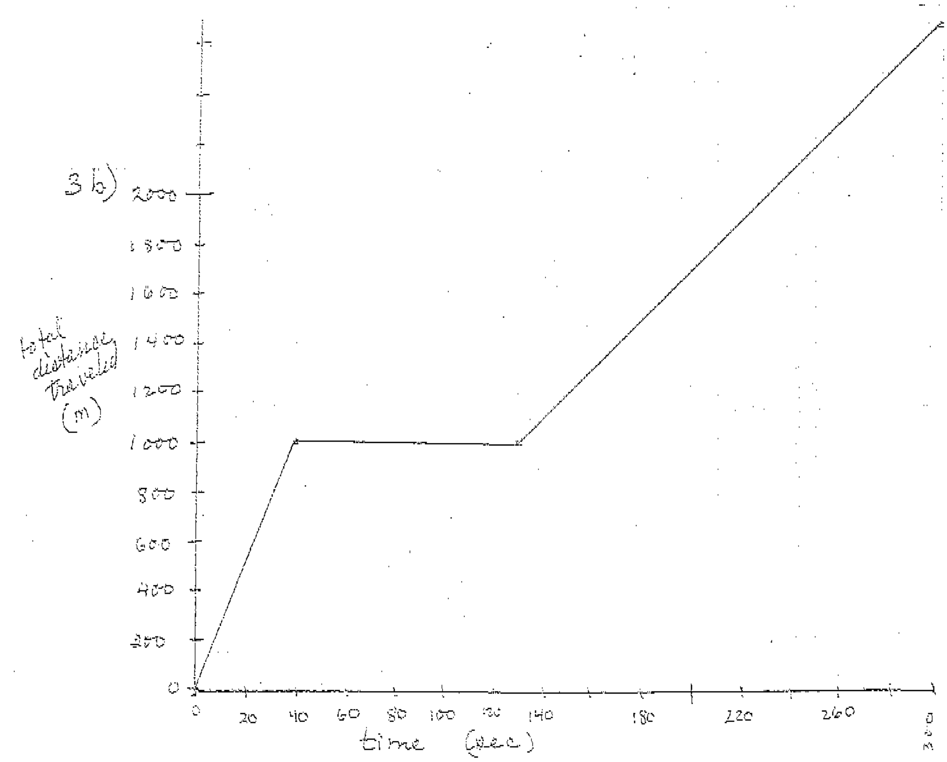
so $d = \frac{22\,m}{s} \times 10\,sec = \boxed{220\,m}$

③ a) $d = vt$, so $t = \frac{d}{v}$ $\quad \frac{1000\,m}{25\,m/s} = 40\,s$ $+ \left(1.5\,min \times \frac{60\,s}{m} = 90\,s\right)$

$+ \left(\frac{1700\,m}{10\,m/s} = 170\,s\right) = 300\,s \times \frac{1\,m}{60\,s} = \boxed{5\,min,\ YES}$

b)

3 b)



④ $a = \frac{\Delta V}{t}$ $\quad a = \frac{0 - 30\,m/s}{3\,sec}$ $\quad \boxed{a = -10\,m/s^2}$

(5) a) $d = vt$ $\quad t = \frac{d}{v}$ $\quad t = \frac{2000m}{20.00m/s}$ $\quad \boxed{t = 100\ sec}$

b) $v = \frac{d}{t}$ $\quad v = \frac{2000m}{1.4s}$

$v = 1429 m/s$
or about $1400\ m/s$

(Remember, the impact occurred 100 seconds after firing so it takes 1.4 sec for sound to return from impact location to the submarine)

(6) Assume air resistance is negligible:

a) $v_f = gt$ $\quad v_f = (10 m/s^2)(15s)$ $\quad \boxed{v_f = 150 m/s}$

b) $d = \frac{1}{2}gt^2$ $\quad d = \frac{1}{2}(10 m/s^2)(15s)^2$ $\quad \boxed{d = 1125 m}$

OR $\bar{v} = \frac{v_0 + v_f}{2}$ $\quad \bar{v} = \frac{0 + 150 m/s}{2}$ $\quad \bar{v} = 75 m/s$ $\quad d = \bar{v}t$ $\quad d = (75 m/s)(15s)$

$\boxed{d = 1125 m}$

(7) Time to go up = time to fall. When falling, $v_0 = 0$, $v_f = 50 m/s$.

$v_f = gt$ $\quad t = v_f/g$ $\quad t = \frac{50 m/s}{10 m/s^2}$ $\quad t = 5\ sec$

$d = \frac{1}{2}gt^2$ $\quad d = \frac{1}{2}(10 m/s^2)(5s)^2$ $\quad \boxed{d = 125 m}$

(8) $d = \frac{1}{2}gt^2$ (solve for time, or substitute directly)

$t = \sqrt{\frac{2d}{g}}$ $\quad t = \sqrt{\frac{2(33.5m)}{10 m/s^2}}$ $\quad t = \sqrt{6.65}$ $\quad \underline{t = 2.58\ sec}$

$v_f = gt$ $\quad v_f = (10 m/s^2)(2.58 s)$ $\quad \boxed{v_f = 25.8 m/s}$

(9) a) time up = time down, so solve for downward direction and double it.

$v_f = gt$ $\quad 40 m/s = (10 m/s^2)t$ $\quad \boxed{t = 4s} \times 2 = \boxed{8 sec}$

b) $d = \bar{v}t$ $\quad \bar{v} = \frac{v_0 + v}{2}$ $\quad \bar{v} = \frac{(40+20)}{2} = 30 m/s$

$d = (30 m/s)(2s) = \boxed{60 m}$

c) $d = \frac{1}{2}gt^2$ $\quad d = \frac{1}{2}(10\,m/s^2)(4\,s)^2$ $\quad \boxed{d = 80\,m}$

d) after 4s, ball will be at its peak, where $v = 0$, so after six seconds, ball will have accelerated from $\boxed{0 - 20\,m/s}$. $\bar{v}_{down} = \frac{0+20}{2} = 10\,m/s$

e) $d_{down} = (10\,m/s)(2\,sec)$ $\quad d = 20$ meters below peak

$d = 80 - 20 =$ $\boxed{\text{60 meters above starting point}}$

OR, for d and e, assuming up is positive and down is negative: $\quad g = -10\,m/s^2$

d) $v_f = v_0 + at$

$= \frac{40\,m}{s} + (-10\,\frac{m}{s^2})\,6\,sec =$

$= 40 - 60$ or $\boxed{-20\,m/sec}$

e) $d = v_0 t + \frac{1}{2}gt^2$

$= (\frac{40\,m}{s})(6\,s) + \frac{1}{2}(-\frac{10\,m}{s^2})(6\,s)^2$

$= 240 - 180$ $\quad \boxed{d = 60\,m}$

(10) At time $t = 0$, the object is at a distance of 0.5 m and is traveling with a small forward speed. The speed increases (it accelerates) for about 3 seconds, when the speed gradually decreases for another second. At the end of 4 seconds, the object is either moving very slowly, or it is stopped. It is hard to tell from the graph. (The object may have started from rest, accelerated, decelerated, and come to a stop)

(11.)

In this case, the slope of the velocity-time graph is constant and negative, which means the acceleration is constant and negative. Note that the velocity starts positive, passes through zero, and ends negative. For this object, $a = -5\,m/s^2$. The motion begins in one direction and ends up in the opposite direction. (If the acceleration were $10\,m/s^2$ I would guess this represented an object thrown straight up.)