2.3 Check and Reflect

#1. G: $t = 3.0\,s$

$\vec{a} = 1.0\ cm/s^2\ [f]$

$\vec{v}_i = 5.0\ cm/s\ [f]$

-b ⟷ f+

R: $d = ?\ [m]$

A: $d = v_i t + \frac{1}{2} a t^2$

S: $d = (5.0)(3.0) + \frac{1}{2}(1.0)(3.0)^2$

$d = 19.5\ cm$

S: The humanoid robot will travel 2.0×10^1 cm.

#3

G: $\vec{a} = 3.75\ m/s^2\ [f]$

$t = 5.65\ s$

$b^{-} \longleftrightarrow f^{+}$

$v_i = 0\ m/s$

R: $d = ?\ [m]$

A: $d = v_i t + \frac{1}{2} a t^2$

S: $d = 0(5.65) + \frac{1}{2}(3.75)(5.65)^2$

$d = 59.85\ldots\ m$

S: The car will travel 59.9 m.

#5

G: $d = 2.6\ km = 2600\ m$

$v_i = 0\ m/s$

$a = 42.5\ m/s^2$

R: $t = ?\ [s]$

A: $d = v_i t + \frac{1}{2}at^2$

as $v_i = 0\ m/s$ $d = 0 + \frac{1}{2}at^2$

so $t = \sqrt{\frac{d}{\frac{1}{2}a}}$

S: $t = \sqrt{\frac{2600}{\frac{1}{2}(42.5)}}$

$t \doteq 1.1 \times 10^1\ s$

$t \doteq 11\ s$

S: It will take 11 seconds.

#6

G: $v_i = 14.0\ m/s$

$v_f = 0\ m/s$

$t = 5.60\ s$

R: $d = ?\ [m]$

A: $a = \frac{v_f - v_i}{t}$ and $d = v_i t + \frac{1}{2} a t^2$

S: $a = \frac{0 - 14.0}{5.60}$ $d = (14.0)(5.60) + \frac{1}{2}(-2.5)(5.6)^2$

$a = -2.5\ m/s^2$ $d = 39.2\ m$

S: The skidding distance is 39.2 m

$$\frac{50\ km}{1\ h} \times \frac{1000\ m}{1\ km} \times \frac{1\ h}{3600\ s}$$

\#7

G: $v_i = 50\ km/h \rightarrow 13.\overline{8}\ m/s$

$v_f = 30\ km/h \rightarrow 8.\overline{3}\ m/s$ $\quad \frac{30\ km}{1\ h} \times \frac{1000\ m}{1\ km} \times \frac{1\ h}{3600\ s}$

$d = 150\ m$

R: $a = ?\ [m/s^2]$

A: $v_f^2 = v_i^2 + 2ad \rightarrow \frac{v_f^2 - v_i^2}{2d} = a$

S: $a = \frac{(8.\overline{3})^2 - (13.\overline{8})^2}{[(2)(150)]}$

$a \doteq -0.41\ m/s^2$

S: The magnitude of the car's acceleration is $0.41\ m/s^2$.

9

G: $v_i = 0$ m/s

$\vec{d} = 150$ m [W]

$t = 2.00$ s

R: $a = ?$ [m/s²] [W]

A: $d = \underbrace{v_i t}_{=0} + \frac{1}{2}at^2 \rightarrow d = \frac{1}{2}at^2$

$$\frac{d}{\frac{1}{2}t^2} = a = \frac{2d}{t^2}$$

S: $a = \frac{2d}{t^2}$

$a = \frac{2(150)}{2.00^2}$

$a = 75$ m/s² [W]

S: The rocket's acceleration is 75.0 m/s² [W].

#10

$$\frac{241\ km}{1\ h} \times \frac{1000\ m}{1\ km} \times \frac{1\ h}{3600\ s}$$

G: $v_i = 0\ m/s$

$v_f = 241\ km/h = 66.9\bar{4}\ m/s$

$d = 96.0\ m$

R: $a = ?\ [m/s^2]$

A: $v_f^2 = v_i^2 + 2ad \rightarrow \frac{v_f^2 - v_i^2}{2d} = a$

S: $a = \frac{(66.9\bar{4})^2 - 0^2}{2(96.0)}$

$a = 23.3\ m/s^2$

S: The magnitude of the jet's acceleration is $23.3\ m/s^2$.

$23.3\ m/s^2 \doteq 3.02 \times 10^5\ km/h^2$

#12

G: $d = 39.0\ m$ $\qquad \frac{97km}{1h} \times \frac{1000m}{1km} \times \frac{1h}{3600s}$

$v_f = 0\ m/s$

$v_i = 97.0\ km/h \rightarrow 26.9\bar{4}\ m/s$

R: $a = ?\ [m/s^2]$

A: $v_f^2 = v_i^2 + 2ad \rightarrow \frac{v_f^2 - v_i^2}{2d} = a$

S: $$a = \frac{0^2 - 26.9\bar{4}^2}{(2(39.0))}$$

$$a \doteq -9.31\ m/s^2$$

S: The car's acceleration has a magnitude of $9.31\ m/s^2$.

#14

G: $\vec{v}_i = 9.0\ m/s\ [N]$

$\vec{d} = 1.54\ km\ [N] \rightarrow 1540\ m\ [N]$

$t = 2.0\ min \rightarrow 120\ s$

R: $a = ?\ [m/s]\ [N]$

A: $d = v_i t + \frac{1}{2}at^2$

$$\frac{d - v_i t}{\frac{1}{2}t^2} = a$$

S: $a = \frac{1540 - (9.0)(120)}{\left[\frac{1}{2}(120)^2\right]}$

$a = 6.4 \times 10^{-2}\ m/s^2\ [N]$

S: The submarine acceleration is $6.4 \times 10^{-2}\ m/s^2$ [N].