Q1 2 pts A conventional, “automatic” car has a gas pedal, brake pedal, steering wheel plus other controls to operate the car. Which of these can be used to change the velocity of the car? Circle the one best answer.

a) The brake and gas pedal.
b) The gas pedal.
c) The gas pedal, brake pedal and steering wheel.
d) None of the above answers is correct.

Q2 2 pts You toss a ball directly upwards with some initial velocity. The ball reaches some height and then falls back to the ground. What can you say about the acceleration of the ball after it has left your hand and just before it strikes the ground? Circle the single best answer.

a) The acceleration is constant throughout the flight.

b) The acceleration is constant in magnitude but changes direction when the ball starts downward.

c) The acceleration direction is constant but changes in magnitude during the ball's flight.

d) None of the above answers is correct.

Q3 10 pts During the construction of one of the new SMU buildings, a cement block accidentally falls from rest from the ledge of a 53-m-high building. When the block is 14.0 m above the ground, SMU President Turner, 2.0 m tall, looks up, and notices that the block is directly above him. How much time T, at most, does Prez Turner have to get out of the way before the brick conks him on the head and disturbs his mysterious hair?

define down to be positive

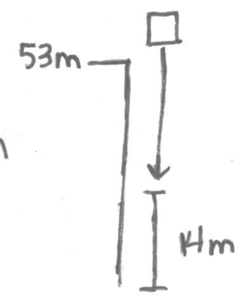
$\downarrow +y$

initial descent:

$a = g$

$y_i = 53m, \; y_f = 14m$

$v_0 = 0, \; v = ?$



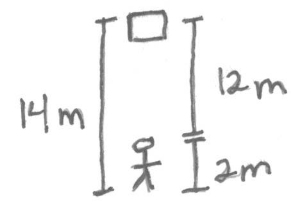
$$v^2 = v_0^2 + 2a(y_f - y_i)$$

$$v = \sqrt{2g(y_i - y_f)} \approx 27.65 \text{ m/s}$$

second part:

$\Delta y = 12m \qquad t = ?$

$v_i = v$ (above) $\qquad a = g$



$$\Delta y = vt + \tfrac{1}{2}at^2$$

$$\tfrac{1}{2}at^2 + vt - \Delta y = 0$$

plug in values, solve for t

$\longrightarrow \boxed{t \approx 0.4s}$

Brick falling on President Turner's hair problem

alternate solution:

total time to fall from 53 m to 2 m:

$$\Delta y = \cancel{v_0 t}^{\,0} + \frac{1}{2}at^2$$

$$53m - 2m = \frac{1}{2} \cdot 9.8 (m/s^2) t^2$$

$$\rightarrow t_1 = 3.2 s$$

time to fall from 53 m to 14 m:

$$\Delta y = 53m - 14m = \frac{1}{2} \cdot (9.8 m/s^2) t^2$$

$$t_2 \approx 2.8 \text{ s}$$

time to move = time to fall from 14m to 2m

$$= t_1 - t_2 = 0.4 s$$

Q4 10 pts The left ventricle of the heart accelerates blood from rest to a velocity of +26 cm/sec. You can assume for this question that the blood travels in a straight line. I recommend you do your calculation using centimeters. This is a rare case where we will not use meters for lengths and displacements in a calculation.

a) 5 pts If the displacement of the blood during the acceleration is +2.0 cm, determine its acceleration $\vec{a}$ (in cm/sec^2).

$$V^2 = V_0^2 + 2a\Delta X$$

$$\rightarrow \quad a = \frac{V^2 - V_0^2}{2\Delta X} = \frac{(26\ \text{cm/s})^2}{2(2\ \text{cm})}$$

$$\rightarrow \quad \boxed{a = 169\ \text{cm/s}^2}$$

b) 5 pts How much time t does it take for the blood to reach its final velocity?

$$v = v_0 + at$$

$$t = \frac{v - v_0}{a} = \frac{26 \text{ cm/s}}{169 \text{ cm/s}^2}$$

$$\boxed{t \approx 0.154 \text{ s}}$$

Q5 10 pts A car is traveling on a dry road in a straight line with a velocity $\vec{v} = +32.0\,\text{m/s}$. Take the positive direction to be toward the right. The driver, texting wildly, slams on the brakes and skids to a halt with a constant acceleration $\vec{a} = -8.00\,\text{m/s}^2$. On an icy road, the car would have skidded to a halt with an acceleration $\vec{a} = -3.00\,\text{m/s}^2$. How much *farther* Δs would the car have skidded on the icy road compared to the dry road? Box that answer!

use $v^2 = v_0^2 + 2a\Delta x$

$\longrightarrow +x$

Dry road: $\Delta x = \dfrac{0^2 - (32\,m/s)^2}{2(-8\,m/s^2)} = 64\,m$

Icy road: $\Delta x = \dfrac{0^2 - (32\,m/s)^2}{2(-3\,m/s^2)} \approx 170.7\,m$

$\Delta s = 170.7\,m - 64\,m$

$\boxed{\Delta s = 106.7\,m}$