1. In order to receive credit for this problem, you must correctly code ("bubble") both your 8-digit UFID and your 5-digit test number onto your scan sheet and also select the correct response below. Check right now that both numbers are correctly bubbled. Code your UFID as if it were an ordinary 8-digit number and do not insert a blank space or hyphen in the middle.

   (1) I have correctly bubbled my UFID and test number.
   (2) I don't think this is important.
   (3) I bubbled the wrong test number.
   (4) I don't have time to check.
   (5) I bubbled the wrong UFID.

2. Professor Meisel lives 7.5 miles from campus and he takes 35 minutes to make this trip. What is his average speed in km/hr?

   (1) 29     (2) 0.5     (3) 18     (4) 11.2     (5) 3.0

3. A diver running at 5.0 m/s dives out horizontally from the edge of a platform that is 3 m from the water. How long does it take the diver to hit the water?

   (1) 0.78 s   (2) 0.31 s   (3) 0.67 s   (4) 1.57 s   (5) 0.05 s

4. (CONTINUATION) When the diver hits the water, what is the horizontal distance back to the point where she left the platform?

   (1) 3.9 m   (2) 1.55 m   (3) 3.35 m   (4) 7.85 m   (5) 0.25 m

5. What is the acceleration of a car that travels on a straight road from rest to 75 km/hr in 8 s?

   (1) 2.6 m/s²  (2) 2.8 m/s²  (3) 3.6 x 10⁴ km/hr²  (4) 600 km/s²  (5) Not enough information to tell

6. A stone is dropped from a cliff and is seen to hit the ground 3.0 s later. How high was the cliff?

   (1) None of these values are correct. (2) 29.4 m   (3) 288 m   (4) 10 m   (5) 88.2 m

7. John Force drove his funny car 0.25 miles when starting from rest. His speed at the end of the quarter mile was 375 miles/hr. Assuming that he experienced constant acceleration for the entire trip, what is the magnitude of the acceleration in m/s²?

   (1) 34.9   (2) 281,250   (3) 3.5 x 10⁻²   (4) 9.8   (5) 375

8. Mia Haunm kicked a soccer ball that traveled 30 m. If the ball initially left the ground with a speed of 20 m/s, what was the angle between the initial velocity vector and horizontal ground?

   (1) 23.55°   (2) 30°   (3) 60°   (4) 45°   (5) None of the values listed are correct.

9. From the graph shown in Figure 1, how much distance was covered between 3 s and 8 s?

   (1) 6 m   (2) 9 m   (3) 15 m   (4) 2.5 m   (5) zero

10. From the graph shown in Figure 1, what is the speed between 6 s and 10 s?

    (1) 1.75 m/s   (2) 6 m/s   (3) 3.3 m/s   (4) 12 m/s   (5) None of these choices are correct.
11. A car, starting from rest, rolls down a hill. Assume there is no friction, and the speed at the bottom of the hill is 12 m/s. How high is the hill?
   (1) 7.3 m   (2) 12 m   (3) 9.8 m   (4) 14.7 m   (5) Not enough information is given to answer.

12. An object has a constant acceleration of 5 m/s². At a certain instant, its velocity is 100 m/s. What was its velocity 2 s earlier?
   (1) 90 m/s   (2) 100 m/s   (3) 45 m/s   (4) 95 m/s   (5) Not enough information to tell.

13. A 2.0 kg ball is thrown straight up over the edge of a building that is 50 m high as measured to the ground. The initial speed of the ball is 12 m/s. How long does it take to reach its maximum height?
   (1) 1.2 s   (2) 7.3 s   (3) 12 s   (4) 4.2 s   (5) 8.4 s

14. [CONTINUATION] How long does it take the ball to reach the ground after it is initially tossed into the air?
   (1) 4.6 s   (2) 2.45 s   (3) 1.2 s   (4) 7.3 s   (5) Not enough information given to answer this part.

15. Five blocks, each 10.0 cm thick with a mass of 1.5 kg, lie flat on a sidewalk. How much work is required to stack them one on top of another?
   (1) 14.7 J   (2) 147 J   (3) 150 J   (4) 750 J   (5) Not enough information given to answer this part.

16. A force of 125 N is applied to a full grocery cart whose mass is 35 kg. There is a frictional force of 100 N acting against the motion. What is the acceleration of the cart?
   (1) 0.71 m/s²   (2) 1.4 m/s²   (3) 6.4 m/s²   (4) 875 m/s²   (5) 8.75 m/s²

17. A person in an airplane traveling at 50 m/s wants to drop a package into the stadium located at ground level. The airplane is 300 m above the ground. How many seconds before the airplane is directly overhead should the package be dropped?
   (1) 7.32 s   (2) 6.03 s   (3) 1.14 s   (4) 61 s   (5) 3.14 s

18. In the Tour de Georgia, the riders climb Brasstown Bald starting at an elevation of 2000 ft and ending at an elevation of 4500 ft. The distance traveled on the road is 10 miles. If a biker has a mass of 60 kg, what is his change in potential energy?
   (1) 485 kJ   (2) 1.6 MJ   (3) 65 J   (4) 65 W   (5) The correct value is not listed as an option.

19. The average power developed by lifting a mass of 5 kg to a height of 6 m in a time of 3 s?
   (1) 98 W   (2) 9.8 W   (3) 98 J   (4) 90 W   (5) 90 J

20. What net force is needed to bring a 1000 kg car to rest from 90 km/hr in a time of 5.0 s?
   (1) 5000 N   (2) 11 N   (3) 9.8 N   (4) 5 N   (5) 1000 N
Figure 1: Distance versus Time

\[ v = \frac{15 \text{ m} - 8 \text{ m}}{10 \text{ s} - 6 \text{ s}} = \frac{7 \text{ m}}{4 \text{ s}} = \frac{7}{4} \text{ m/s} = 1.75 \text{ m/s} \]
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Model

2. \( t = \text{25 min} \)
\( \frac{d}{t} = 7.5 \text{ mi}(s) \)
\( V = \frac{d}{t} = \frac{7.5 \text{ mi}}{25 \text{ min}} \left(\frac{60 \text{ min}}{1 \text{ hr}}\right) \left(\frac{1 \text{ km}}{0.621 \text{ mi}}\right) \)
\( V = 29 \text{ km/hr} \)

3. \( V_{0y} = \frac{5 \text{ m}}{3} \)
\( \text{Use } y \text{-analysis} \)
\( y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2 \)
\( -3 = 0 + 0 + \frac{1}{2} \left( -9.8 \frac{\text{m}}{\text{s}^2} \right) t^2 \)
\( t^2 = \frac{6}{9.8 \frac{\text{m}}{\text{s}^2}} = 0.6122 \Rightarrow t = 0.78 \text{ s} \)

4. From above: \( V_{0y} = \text{const} = \frac{5 \text{ m}}{3} \) \( t = 0.78 \text{ s} \)
\( V = \frac{d}{t} \Rightarrow s = V t = \left(\frac{5 \text{ m}}{3}\right)(0.78 \text{ s}) \)
\( s = 3.9 \text{ m} \)

5. \( V_0 = 0 \) \( V_f = 75 \text{ km/hr} \) \( t = 8 \text{ s} \)
\( a = \frac{V - V_0}{t} \)
\( a = \frac{75 \text{ km/hr}}{3600 \text{ s}} \left(\frac{1 \text{ hr}}{1 \text{ km}}\right) \left(\frac{1000 \text{ km}}{1 \text{ mi}}\right) \)
\( a = 2.1 \frac{\text{m}}{\text{s}^2} \)

6. \( V_0 = 0 \) \( h = \text{?} \)
\( y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2 \)
\( -h = 0 + 0 + \frac{1}{2} \left(-9.8 \frac{\text{m}}{\text{s}^2}\right) (3 \text{ s})^2 \)
\( h = 4.4 \text{ m} \)
\[ V_0 = 0 \quad V_f = 375 \text{ mi/hr} \]

\[ a = \frac{V_f^2 - V_0^2}{2(x - x_0)} \]

\[ a = \left( \frac{375 \text{ mi/hr}}{1 \text{ hr}} \right) \left( \frac{1 \text{ hr}}{3600 \text{ s}} \right) \left( \frac{1 \text{ km}}{0.621 \text{ mi}} \right) \left( \frac{1000 \text{ m}}{1 \text{ km}} \right) \]

\[ a = 3.49 \frac{\text{ m}}{\text{s}^2} = 3.5 \text{ g's (about same as space shuttle lift off)} \]

\[ V_0 = 20^\circ \]

\[ R = 30 \text{ m} \]

\[ R = \frac{V_0^2 \sin(2\theta_0)}{g} \]

\[ \sin(2\theta_0) = \frac{Rg}{V_0^2} \]

\[ \theta_0 = \frac{1}{2} \sin^{-1} \left[ \frac{(30 \text{ m})(9.8 \frac{\text{ m}}{\text{s}^2})}{(20 \frac{\text{ m}}{\text{s}})^2} \right] = 23.6^\circ \]

\[ V_0 = 0 \]

\[ h = \frac{1}{2} \left( \frac{17 \text{ m}}{\text{s}} \right)^2 \]

\[ h = 7.3 \text{ m} \]

\[ V_0 = 100 \text{ m/s} \]

\[ \alpha = 5 \frac{\text{ m}}{\text{s}^2} \]

\[ t = 2 \text{ s} \]

\[ V_0 = V - at = 100 \frac{\text{ m}}{\text{s}} - (5 \frac{\text{ m}}{\text{s}^2})(2 \text{ s}) \]

\[ V = 90 \frac{\text{ m}}{\text{s}} \]
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13. \[ S \begin{align*}
& \begin{align*}
& V_0 = 12 \text{ m/s} \\
& V_x = 0 \text{ at max height}
\end{align*}
\end{align*}
\]

\[ t = \frac{V_y - V_{0y}}{a_y} \]

\[ -9.8 \text{ m/s}^2 = \frac{0 - 12 \text{ m/s}}{t} \]

\[ t = 1.22 \text{ s} \]

14. same as above

\[ y = y_0 + V_{0y} t + \frac{1}{2} a_y t^2 \]

\[ -50 \text{ m} = 0 + (12 \text{ m/s}) t - \frac{1}{2} (9.8 \text{ m/s}^2) t^2 \]

\[ 9.8 \frac{\text{m}}{\text{s}^2} t^2 - 24 \text{ m} t - 100 \text{ m} = 0 \]

\[ t = \frac{-24 \text{ m ± } \sqrt{(-24 \text{ m})^2 - 4 (9.8 \frac{\text{m}}{\text{s}^2}) (-100 \text{ m})}}{2 (9.8 \frac{\text{m}}{\text{s}^2})} \]

\[ t = \frac{24 \text{ m} ± \sqrt{576 \text{ m}^2 + 3920 \text{ m}^2}}{19.6 \frac{\text{m}}{\text{s}^2}} = \frac{24 \text{ m} ± 67.05 \text{ m}}{19.6 \frac{\text{m}}{\text{s}^2}} \]

\[ t = 4.6 \text{ s} \]

and \( t < 0 \) is neglected

15. \[ U_1 = mg \cdot h \]

\[ U_2 = mg \cdot \frac{h}{2} \]

\[ U_3 = mg \cdot 3h \]

\[ U_{total} = mg \cdot (10 \text{ m}) = (1.5 \text{ kg}) (9.8 \frac{\text{m}}{\text{s}^2}) (10 \text{ m}) \]

\[ U_4 = mg \cdot 4h \]

\[ = 147 \text{ J} \]
16. \( F_{net} = ma = 125N - 100N = 25N \)

\[ a = \frac{F_{net}}{m} = \frac{25N}{35kg} = 0.7 \text{ m/s}^2 \]

17. \( y = y_0 + v_{0y}t + \frac{1}{2} a_y t^2 \)

\(-300m = 0 + 0 + \frac{1}{2} (-9.8m/s^2) t^2 \)

\[ t = \frac{600m}{9.8m/s^2} \Rightarrow t = 78.2s \]

18. \( U = mgh = \)

\( = (65kg)(9.8m/s^2)(1500ft + 2000ft)(\frac{1m}{3.28ft}) \)

\( U = 485 \text{ kJ} \)

19. \( d = \frac{1}{2}at^2 \)

\( m = 5kg \)

\( t = 3s \)

\( d = 6m \)

\( P = \frac{W}{t} = \frac{Fd}{t} = Fv \)

\( = (5kg)(9.8m/s^2)(\frac{6m}{3s}) \)

\( P = 98W \)

20. \( F = ma \) need \( a = ? \)

\( a = \frac{v_f - v_0}{t} = \frac{0 - 90km/hr}{5s} \)

\( \frac{1km}{3600s} \) \( \frac{1000m}{5s} \)

\( F = (10^3kg)a = 5000N \)