Quiz #3 Ch.#4 T133 Phys101.02-v1

Student ID:..... **Student Name:**.....

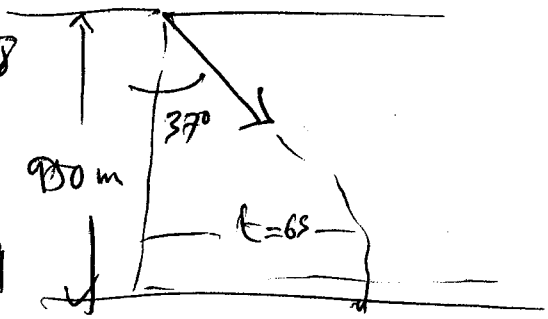
Q1. **Q13.** A plane, diving with constant speed at an angle of 37.0 degrees with the vertical, releases a package at a height of 950 m. The package hits the ground 6.00 s after release. Find the speed of the plane. (Ans: 161 m/s)

$-950 = -V_0 \cos 37 \times 6 + \frac{1}{2} \times 9.8 \times 36$

$950 - 9.8 \times 18 = V_0 \cos 37 \times 6$

$773.6 = V_0 \cos 37 \times 6 = V_0 \times 4.79$

$V_0 = \frac{773.6}{4.79} = 161.4 \text{ m/s}$



Q#2.: Q11. A boy wishes to swim across a river from *A* to *B*. He can swim at 1.0 m/s in still water and the river is flowing at 0.50 m/s (Fig 3, T061). At what angle θ should he be heading?

$\vec{V}_{bw} \cos\theta = V_{wg} = 0.5$

$\theta = \cos^{-1}\left(\frac{0.5}{V_{bw}}\right) = \cos^{-1}\left(\frac{0.5}{1.0}\right)$

$= 60°$

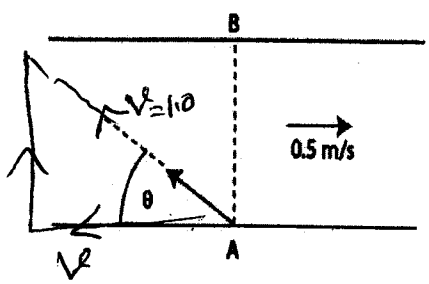


Figure 3

Quiz #3 Ch.#4 T133 Phys101.02-v2

Student ID:..... **Student Name:**.....

Q#1. An arrow is shot horizontally from a point *P* toward *X* as shown in Fig 2, T061. It hits at a point *Y*, 0.20 m below point x later. If the the distance *PX = 1.2 m, determine speed* of the arrow at *P*. (Ans: 6.0 m/s)

$t = \sqrt{\frac{2y}{g}} = \sqrt{\frac{2\times 0.2}{9.8}} = 0.20$ sec

$t = 0.25$

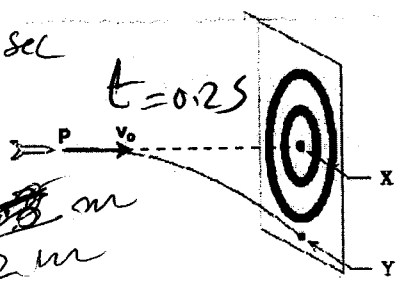


Figure 2

of the distance PX = 1.2 m, find

$V_0 = \frac{1.2}{0.2} = 6.0$ m/s

Q#2. A river is flowing 0.20 m/s east. A boat in this river has a speed of 0.40 m/s directed 60° south of east relative to the earth. Find the velocity of the boat relative to the river.(Ans: 0.35 m/s, south)

$\vec{V}_{bw} = \vec{V}_{bg} + \vec{V}_{gw}$

$= \vec{V}_{bg} - \vec{V}_{wg}$

$= V_{bg}\cos\theta\, i - 0.2\, i - V_{bg}\sin\theta\, j$

$= 0.2i - 0.2i - 0.35j = -0.35j$ (40.35 S of E)

Quiz #3 Ch.#4 T133 Phys101.02-v3

Student ID:..... **Student Name:**.....

new

Q1 A ball is thrown upward with a speed v_0 at an angle of 45° above the horizontal. It reaches a maximum height of 8.0 m. What is the maximum height this ball would go if it is thrown upward with a speed (2 v_0) at an angle of 45° above the horizontal? A) 32 m

$$h = \frac{V_{oy}^2}{2g} \quad , h' = \frac{V_{oy}'^2}{2g}$$

$$\frac{h'}{h} = \frac{V_{oy}'^2}{V_{oy}^2} = \frac{(2V_{oy})^2}{V_{oy}^2} = 4$$

$$h' = 4h = 4 \times 8 = 32\ m$$

Q2. **T041: Q10:** Car A travels with velocity (30 j) m/s (relative to the ground) and car B travels with speed of 50 m/s in a direction making an angle of 37 degrees with +x axis (relative to the ground) (see Fig 9). What is the velocity of car A relative to car B ? (A1): (-40i) m/s

$$\vec{V}_{AB} = \vec{V}_{Ag} + \vec{V}_{gB} = \vec{V}_{Ag} - \vec{V}_{Bg}$$

$$= 30j - V_{Bg}\cos 37\, i - V_{Bg}\sin 37\, j$$

$$= -50\cos 37\, i$$

$$= 30j - 39.93i - 30.09j$$

$$= -39.93i = -40i$$

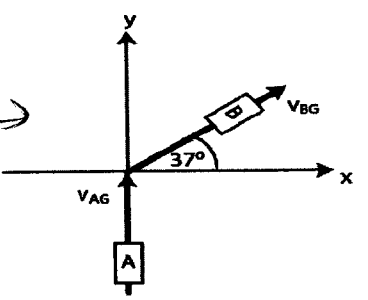


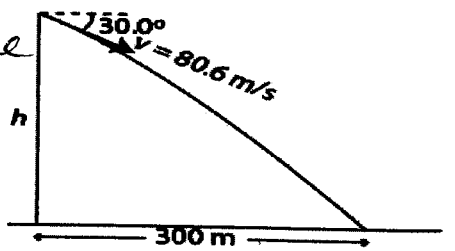
Figure 9

Q12: A particle moves at ...

Quiz #3 Ch.#4 T133 Phys101.02-v4

Student ID:..... **Student Name:**.....

Q1. A certain airplane has a speed of 80.6 m/s and is diving at an angle of 30.0° below the horizontal when it releases an object. The horizontal distance from the point of release was 300. m as shown in Fig.4. How high was the point of release of the object? (Ans: 264 m)



$t = \frac{300}{V_0 \cos\theta} = \frac{300}{80.6 \times \cos 30} = 4.3\ sec$

$-y = -V_{0y}t - \frac{1}{2}gt^2$

$= -80.6 \times 4.3 \times \sin 30 - \frac{1}{2} \times 9.8 \times (4.3)^2$

$-y = -173.3 - 90.60 = -263.9\ m$

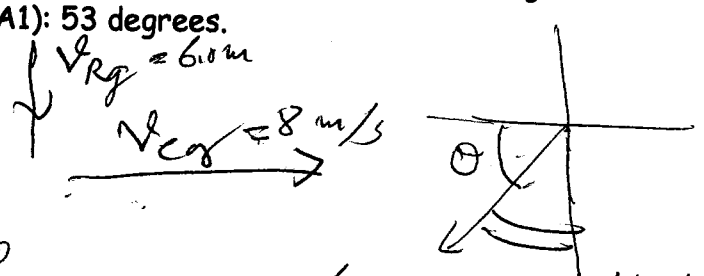
Q2. Q11: Rain is falling vertically at constant speed of 6.0 m/s. At what angle from the vertical do the rain appear to be falling as viewed by the driver of a car traveling on a straight, level road with a speed of 8.0 m/s? (A1): 53 degrees.

$V_{RC} = V_{Rg} + V_{gC}$

$= V_{Rg} - V_{Cg}$

$= -6.0\vec{j} - 8\vec{i}$

$\theta = \tan^{-1}\left(\frac{-6}{-8}\right) = 36.86^\circ = 90 - 36.86 = 53.13^\circ$ with the vertical



Student ID:..... **Student Name:**.....

New **Q#1:** A stone is thrown horizontally from the top of a 40m high hill. It strikes the ground at an angle of 30 degrees as shown in Fig.2. With what speed was it thrown? (A1): 49 m/s.

$V_{fy}^2 = V_{iy}^2 - 2|g|y$

$V_{fy} = \sqrt{+2|g||y|} = 28$

$= \sqrt{2 \times 9.8 \times 40}$

$V_{fy} = V_0 \sin 30 = 28$

$V_{0x} = V_0 \cos 30 = \frac{28}{\sin 30} \times \cos 30 = 28/\tan 30$

$= 48.497 = 49 \text{ m/s}$

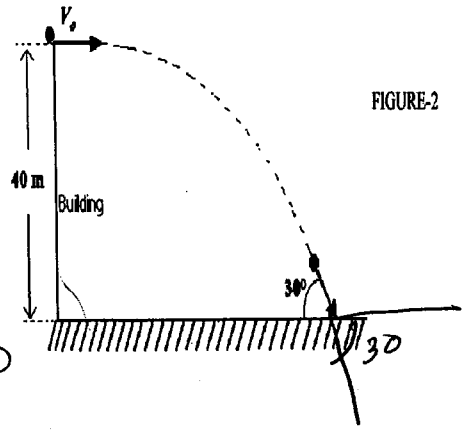


FIGURE-2

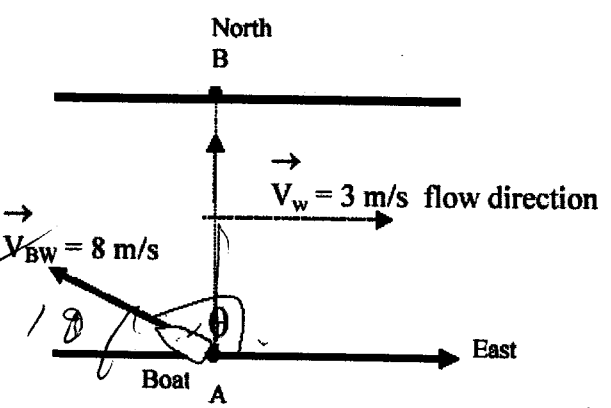
Q2. Q13: A wide river has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves point (A) and heads in such a way that it crosses to a point (B) (see Fig.2). In what direction relative to east must the boat be pointed? (A1): 112 degrees.

$8 \cos\theta = 3$

$\theta = \cos^{-1}\left(\frac{3}{8}\right) = 67.98$

$= 68.0$

$\theta = 180 - 68 = 112^\circ$



6

Quiz #3 Ch.#4 T133 Phys101.02-v6

Student ID:..... **Student Name:**.....

Q#1:. The plane shown in Fig 2, is in a level flight at a height of 490 m and a speed of 50 m/s when a package was released. The horizontal distance between the release point and the point where the package strikes the ground is: Ans: D) 500 m

$$t = \sqrt{\frac{2h}{|g|}} = \sqrt{\frac{2\times 490}{9.8}} = 10.0\,s$$

$$d = vt = 50\times 10 = 500\,m$$

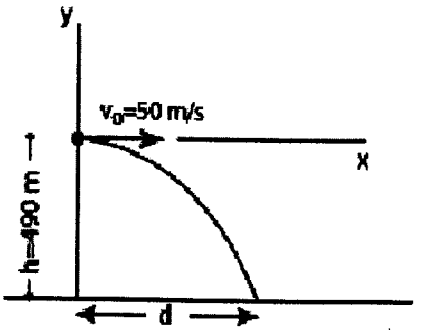


Figure 2

Q#2: . Car A is moving towards East with speed 15.0 m/s and car B is moving towards West with speed 25.0 m/s, both relative to the ground. Find the velocity of car B relative to car A.(Ans: 40.0 m/s towards West)

$\vec{V}_{A0} = 15\ m/s$ →

$\vec{V}_{B0} = 25\ m/s$ ←

$$\vec{V}_{BA} = \vec{V}_{Bg} + \vec{V}_{gA} = \vec{V}_{Bg} - (\vec{V}_{Ag})$$

$$= -25\,\vec{i} - 15\,\vec{i}$$

$$\vec{V}_{BA} = -40\,\vec{i}$$

Student ID:..... **Student Name:**.....

New

Q#1: A projectile is thrown from a height H with a speed of 10.0 m/s at an angle of 30 degrees below horizontal as shown in Fig 10. Find H , if the horizontal distance x = 20.0 m . (A1): 37.7 m .

$t = \frac{20}{V_0 \cos 30} = \frac{20}{10 \times \cos 30} = 2.31$ sec

$-H = -10 \sin 30 \times 2.31 - \frac{1}{2} \times 9.8 \times (2.31)^2$

$= -11.55 - 26.15$

$-H = -37.70$

$H = 37.7$ m

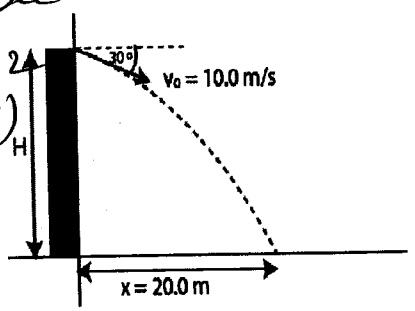


Figure 10

Q2. Q11: Two roads intersect as shown in Figure 4. At this instant, a police car (P) is approaching the intersection along the x-axis at 80 km/h while a truck (T) is moving along the y-axis at 60 km/h. What is the velocity of the police car relative to truck? (A1): (80 i - 60 j) km/h

$\vec{V}_{PT} = \vec{V}_{Pg} + \vec{V}_{gT} = \vec{V}_{Pg} + \vec{V}_{Tg}$

$= 80\vec{i} - 60\vec{j}$

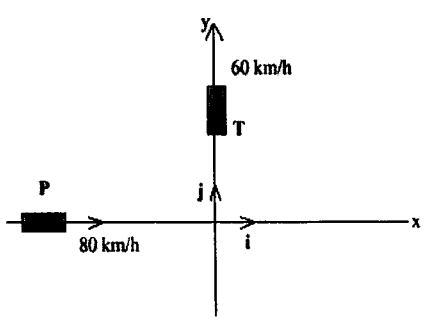


Figure 4

Quiz #3 Ch.#4 T133 Phys101.02-v8

Student ID:.................................... Student Name:.......................................

Q1) Q11: A ball is thrown horizontally from the top of a building 100 m high. The ball strikes the ground at a point 65 m from the base of the building (see figure 3). What is the speed of the ball just before it strikes the ground? (A1): ~~47~~ m/s 29 m/s

$V_0 \cos\theta = \frac{x}{t} = \frac{75}{4} \approx 18.75$

$y = V_{0y} t - \frac{1}{2} (g) t^2$

$10 = V_0 \cos\theta \times 4 - \frac{1}{2} \times 9.8 \times 16$

$10 = 4 V_0 \cos\theta - 78.4$

$V_0 \sin\theta = \frac{10 + 78.4}{4} = 22.1$

$V = \sqrt{(V_0 \cos)^2 + (V_0 \sin\theta)^2} = \sqrt{(18.75)^2 + (22.1)^2} = 28.98 = 29 m/s$

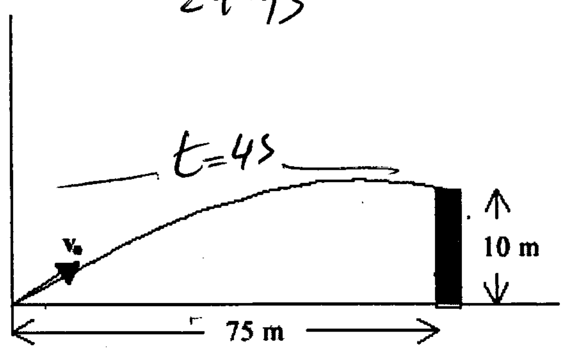


Figure 4

Q2. A river has a steady flow of 0.30 m/s. A student swims downstream a distance of 1.2 km and returns to the starting point. If the student can swim at a constant speed of v in still water and the downstream portion of the swim takes him 20 minutes, the time required for the entire swim is: (A1): 70 minutes.

$V_{wg} = 0.3$, V_{bw}, 1200 m

$t = \frac{1200}{V_{bw} + V_{wg}} = 20\ m$

$\frac{1200}{V_{bw} + 0.3} = 1200 \Rightarrow V_{bw} + 0.3 = 1 \Rightarrow V_{bw} = 1 - 0.3 = 0.7 m/s$

$t_{up} = \frac{1200}{0.7 - 0.3} = \frac{1200}{0.4} = 3000\ sec = 50\ min$

$t_{tot} = 50 + 20 = 70\ min$

Quiz #3 Ch.#4 T133 Phys101.02-v9

Student ID:..... **Student Name:**.....

Q1 The airplane shown in **Figure 4** flies horizontally at an altitude of 1.00 km with a speed of 150 km/h. At what distance D should it release a package to hit the target X?

A) 596 m

$t = \sqrt{\frac{1000 \times 2}{9.8}} = 14.3 \text{ sec} = \frac{14.3}{3600} h$

$D = V_{0x} t = \frac{150 \times 14.3}{3600}$

$= 0.595 \text{ km}$

$= 595 \text{ m}$

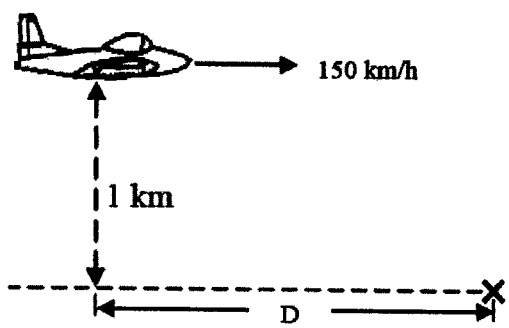
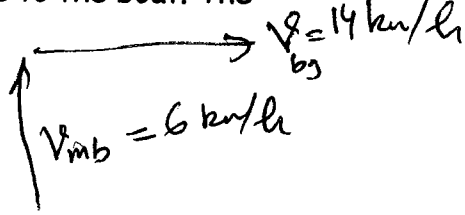


Figure 4

Q2. A boat is traveling at 14 km/h in still water (water is not flowing). A man runs directly across the boat, from one side to the other (perpendicular to the direction of motion of the boat), at 6 km/h relative to the boat. The speed of the man relative to the ground is:

A) 15 km/h



$\vec{V}_{mg} = \vec{V}_{mb} + \vec{V}_{bg} = 6\vec{j} + 14\vec{i}$

$= \sqrt{6^2 + 14^2} = 15.23 \text{ km/h}.$

Quiz #3 Ch.#4 T133 Phys101.02-v10

Student ID:..... **Student Name:**.....

Q1: **Q11**: A ball is thrown horizontally from the top of a building 100 m high. The ball strikes the ground at a point 65 m from the base of the building (see figure 3). What is the speed of the ball just before it strikes the ground? (A1): 47 m/s

$t = \sqrt{\frac{2y}{|g|}} = \sqrt{\frac{2\times 100}{9.8}} = 4.52\,s$

$v_{0x} = \frac{65}{4.52} = 14.39\ m/s$

$v_y = -4.52 \times 9.8 = -44.3\ m/s$

$v = \sqrt{(14.39)^2 + (-44.3)^2} = 46.57\ m/s$

$= 47\ m/s$

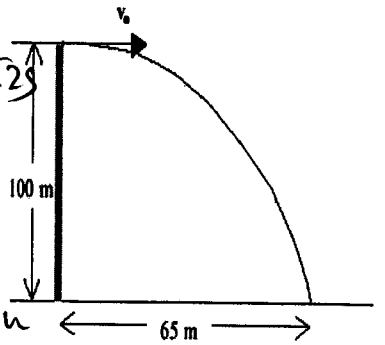


Figure 3

Q2.: : A 140-m wide river flows with a uniform speed of 4.0 m/s toward the east. Starting from a point on the north bank it takes 20 s for a boat to cross the river with constant speed to a point directly across on the south bank. What is the speed of the boat relative to the water?

(A1): 8.1 m/s)

$\vec{v}_{bw} = \vec{v}_{bg} + \vec{v}_{gw}$

$\vec{v}_{bg} = \vec{v}_{bw} - \vec{v}_{wg}$

$|v_{bw}| = 7.1 + 4i$

$= 8.1$