PHYSICS 12 **KINEMATICS QUIZ**

KEY

Name:_____
Date_____

$v_i = 0\ m/s$

/20

[5] **1.** A 5.0-kg object fell and spent 4.25 s in free fall. What was the height is fell from?

G: $m = 5.0\ kg$
$\vec{v}_i = 0\ m/s\ [D]$
$t_{ff} = 4.25\ s$
R: $a_g = 9.8\ m/s^2\ [D]$
$d_y = ?\ [m]$

A: $d_y = v_{iy}t + \frac{1}{2}a_y t^2$

S: $= 0(4.25) + \frac{1}{2}(-9.8)(4.25)^2$
$= -88.50625\ m$

S: The object fell from 89m.

What assumptions do you make?

No obstacles, no other forces except $\vec{F}_g$; vacuum; on Earth.

[5] **2.** An object is thrown with initial velocity of 68.5 m/s 78° above horizontal. How much time does it need to reach its maximum height?

G: $\vec{v}_i = 68.5\ m/s$ 78° above horizontal
$\vec{a}_y = -9.8\ m/s^2$
$\vec{v}_f = 0\ m/s$
R: $t_{hmax} = ?\ [s]$

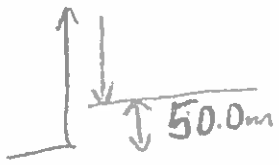
S: $\vec{v}_{iy} = \|\vec{v}_i\| \cdot \sin 78° = 67.0031\ m/s$

$t_{hmax} = \frac{0 - 67.0031}{-9.8} = 6.8\ s$

A: $t_{hmax} = \frac{v_{fy} - v_{iy}}{a_y}$

S: The object needs 6.8 s to reach its maximum height.

$V_{iy} = V_i$



$d_y = h_{max} - 50.0$

$= \frac{0^2 - 45^2}{2(9.8)} - 50.0 = 53.3163\,m$

[5] **3.** A 20-kg object was ejected straight upwards with speed of 45 m/s and landed 50.0 m above the launching level. How much time elapsed between the launching of the projectile and its landing?

G: $m = 20\,kg$

$\vec{v}_i = 45\,m/s[U]$

$a_y = -9.8\,m/s^2$

- lands 50.0m above launching level

R: $t_{air} = ?\,[s]$

A: $t_{air} = t_{h_{max}} + t_{\#}$

A: $t_{air} = \frac{0 - V_{iy}}{a_y} + \sqrt{\frac{2d_y}{a_y}}$

S: $= \frac{-45}{-9.8} + \sqrt{\frac{2(-53.3163)}{-9.2}}$

$= 4.5918 + 3.2986$

$\doteq 7.9\,s$

S: 7.9 s elapsed between launching and landing.

[5] **4.** Find the initial velocity of a projectile that had initial speed of 145.0 m/s and spent 8.2 s in the air. Assume that the air resistance was negligible, there were no other forces acting on the projectile except the gravitational pull of the Earth.

- **What other assumptions do you have to make in order to answer this question?**

G: $v_i = 145.0\,m/s$

$t_{air} = 8.2\,s$

$a_y = 9.8\,m/s^2[D]$

R: $\theta = ?\,[°]$

A: Assume $t_{air} = 2t_{h_{max}}$

$\Rightarrow t_{h_{max}} = \frac{8.2}{2} = 4.1\,s$

$= \frac{0 - V_{iy}}{a_y}$

S: $-V_{iy} = t_{h_{max}} \cdot a_y$

$V_{iy} = -(4.1 \times (-9.8))$

$= 40.18\,m/s$

$\theta = \sin^{-1}\left(\frac{V_{iy}}{V_i}\right)$

$= \sin^{-1}\left(\frac{40.18}{145.0}\right)$

$\doteq 16°$

S: the initial velocity was 145.0 m/s 16° above horizontal.