KEY

First Name:_____ Last Name:_____

L05 – Worksheet – Horizontally Accelerated Motion

$\overrightarrow{\Delta d} = \overrightarrow{d_f} - \overrightarrow{d_i}$	$\overrightarrow{\Delta d_{tot}} = \overrightarrow{\Delta d_1} + \overrightarrow{\Delta d_2} + \ldots$	$\vec{v} = \frac{\overrightarrow{\Delta d}}{\Delta t}$
$\Delta d = v_i t + \frac{1}{2} a t^2$	$\Delta d = \left(\frac{v_1 + v_f}{2}\right) t$	$v_f{}^2 = v_i{}^2 + 2a\Delta d$
$\Delta d = v_i t + \frac{1}{2} a t^2$	$a = \frac{v_f - v_i}{t}$	

Q1: A cat is walking at 1m/s [E] when it sees a mouse. It sprints, accelerating to 4.5 m/s [E] in 2.3 seconds. How much distance was required to get up to speed?

*(Record your **3-digit** answer in the Numerical Response boxes below)*

6	.	3	3

$\vec{v}_i = 1\ m/s\ [E]$

$\vec{v}_f = 4.5\ m/s\ [E]$

$t = 2.3s$

$\Delta \vec{d} = ?$

$$\Delta \vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) t$$

$$\Delta \vec{d} = \left(\frac{1\ m/s\ [E] + 4.5\ m/s\ [E]}{2}\right)(2.3\ s)$$

$$\Delta \vec{d} = 6.325\ m\ [E]$$

so $d = 6.33m$

Q2: A car is initially cruising at 5m/s [E]. It decides to accelerate at a rate of 2m/s^2 [E] for 20 meters. Its final velocity is ***a.bc*** x 10^d m/s [E], where ***a, b, c,*** and ***d*** are ___, ___, ___, and ___.

*(Record your **4-digit** answer in the Numerical Response boxes below)*

1	0	2	1

$\vec{v}_i = 5\ m/s\ [E]$

$\vec{a} = 2\ m/s^2\ [E]$

$\Delta \vec{d} = 20\ m\ [E]$

$\vec{v}_f = ?$

$$v_f{}^2 = v_i{}^2 + 2ad$$

$$v_f{}^2 = (5\ m/s)^2 + 2(2\ m/s^2)(20\ m)$$

$$v_f{}^2 = 25 + 80$$

$$v_f{}^2 = 105$$

$$\vec{v}_f = 10.24695\ m/s\ [E]$$

$$\vec{v}_f \approx 1.02 \times 10^1\ m/s\ [E]$$

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Q3: A car accelerates from 10m/s [E] to 25m/s [E] in 4.3 seconds. What is the magnitude of its acceleration?

*(Record your **3-digit** answer in the Numerical Response boxes below)*

3	.	4	9

$\vec{v}_i = 10\ m/s\ [E]$

$\vec{v}_f = 25\ m/s\ [E]$

$t = 4.3s$

$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$$\vec{a} = \frac{25\ m/s - 10\ m/s}{4.3s}$$

$$\vec{a} = 3.488372\ m/s^2\ [E]$$

$$\vec{a} \approx 3.49\ m/s^2\ [E]$$

Q4: A sports car accelerates from rest to 27.8 m/s [E] in 3.6s. How much distance did it cover while getting up to speed?

*(Record your **3-digit** answer in the Numerical Response boxes below)*

5	0	.	0

$\vec{v}_i = 0\ m/s\ [E]$ ← At rest

$\vec{v}_f = 27.8\ m/s\ [E]$

$t = 3.6s$

$\Delta\vec{d} = ?$

$$\Delta\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right)t$$

$$\Delta\vec{d} = \left(\frac{0\ m/s + 27.8\ m/s}{2}\right)(3.6)$$

$$\Delta d = 50.04\ m\ [E]$$

Q5: A car starts at rest and accelerates for 8 seconds at 3.5 m/s^2 [E]. How much distance did it cover?

*(Record your **3-digit** answer in the Numerical Response boxes below)*

1	1	2	

$\vec{v}_i = 0\ m/s\ [E]$

$\vec{a} = 3.5\ m/s^2\ [E]$

$t = 8s$

$\Delta\vec{d} = ?$

$$\Delta\vec{d} = \vec{v}_i t + \tfrac{1}{2}\vec{a}t^2$$

$$\Delta\vec{d} = (0\ m/s)(8s) + \tfrac{1}{2}(3.5\ m/s^2)(8s)^2$$

$$= (0)(8) + \tfrac{1}{2}(3.5)(8^2)$$

$$= 0 + 112$$

$$\Delta\vec{d} = 112\ m\ [E]$$

$$d = 112\ m$$

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Q6: A car accelerates for 5 seconds at a rate of 1.5 m/s^2 [E]. The total acceleration requires 25m of track. The car's initial velocity must therefore have been _____ m/s [E].

*(Record your **3-digit** answer in the Numerical Response boxes below)*

1	.	2	5

$t = 5s$
$\vec{a} = 1.5 m/s^2 [E]$
$\Delta\vec{d} = 25m [E]$
$\vec{v}_i = ?$

$\Delta\vec{d} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$
$(25m) = \vec{v}_i(5s) + \frac{1}{2}(1.5 m/s^2)(5s)^2$
$25 = 5v_i + 18.75$
$6.25 = 5v_i$
$\vec{v}_i = 1.25 m/s [E]$

Q7: A car is travelling at 27.8 m/s [E] on the highway. Upon seeing a moose ahead, they break hard, decelerating to a stop in 6.5 seconds. What is the magnitude of their acceleration?

*(Record your **3-digit** answer in the Numerical Response boxes below)*

4	.	2	8

$\vec{v}_i = 27.8 m/s [E]$
$\vec{v}_f = 0 m/s [E]$ ← stop
$t = 6.5s$
$\vec{a} = ?$

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$
$\vec{a} = \frac{0 m/s - 27.8 m/s}{6.5s}$
$\vec{a} = -4.28 m/s^2 [E]$ or $+4.28 m/s^2 [W]$

Q8: A car accelerates from rest at a rate of 3 m/s^2 [E] for a total of 20m. How long does this take, in seconds?

*(Record your **2-digit** answer in the Numerical Response boxes below)*

3	.	7	

$\vec{v}_i = 0 m/s [E]$ ← At rest
$\vec{a} = 3 m/s^2 [E]$
$\Delta\vec{d} = 20m [E]$
$t = ?$

$\Delta\vec{d} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$
$20m = (0 m/s)t + \frac{1}{2}(3 m/s^2)(t^2)$
$20 = 0t + 1.5t^2$
$20 = 1.5t^2$
$13.\overline{3} = t^2$
$t = 3.7s$

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Q9: A car driving in reverse at 10 m/s [W] accelerates forward at 5 m/s^2 [E]. How long will it take to reach a forward velocity of 20 m/s [E]?

*(Record your **3-digit** answer in the Numerical Response boxes below)*

6	.	0	0

$\vec{v}_i = -10\ m/s\ [E]$

$\vec{a} = 5\ m/s^2\ [E]$

$\vec{v}_f = 20\ m/s\ [E]$

$t = ?$

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$$5\ m/s^2 = \frac{20\ m/s - (-10\ m/s)}{t}$$

$$5 = \frac{20 - (-10)}{t}$$

$$5 = \frac{30}{t}$$

$$t = \frac{30}{5}$$

$$t = 6.00\ s$$