



# Smart PE: Using Heart Rate Sensors and Step Trackers for Smart PE



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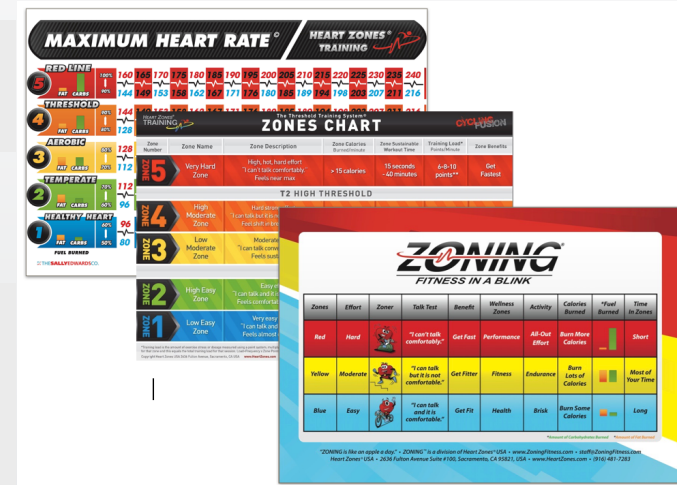


December 2, 2015



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# Terminology

- Ambient Heart Rate
- Delta Heart Rate
- Exercise Heart Rate
- Maximum Heart Rate
- Mid-point Heart Rate
- Minimum Heart Rate
- Peak Heart Rate
- Low Threshold, T1
- High Threshold, T2
- Resting Heart Rate
- Recovery Heart Rate
- Starting Heart Rate





# The Heart Zones System

## The Four Dimensions:

Dimension 1. Curriculum & Materials

Dimension 2. Professional Development


Dimension 3. The Big Board (Class Application)

Dimension 4. Individual Monitor (Watch or BYOD)


**Show Video:** [https://www.youtube.com/watch?v=N3rZ\\_pBqBkg&feature=em-upload\\_owner](https://www.youtube.com/watch?v=N3rZ_pBqBkg&feature=em-upload_owner)

**The 4 Dimensions to the Heart Zones Smart Hearts System**


**Dimension 1**  
Curriculum for Smart PE




**Dimension 2**  
Professional Development



**Dimension 3**  
Display: Big Board & Individual Group



**Dimension 4**  
Sensors: Heart Rate, Activity Tracker, Cycling





# 3 Scientific Cardio-Based Methods

Zones	Effort	Zoner	Talk Test	Benefit	Wellness Zones	Activity	Calories Burned	*Fuel Burned	Time In Zones
Red	Hard		"I can't talk comfortably."	Get Fast	Performance	All-Out Effort	Burn More Calories		Short
Yellow	Moderate		"I can talk but it's not comfortable."	Get Fitter	Fitness	Endurance	Burn Lots of Calories		Most of Your Time
Blue	Easy		"I can talk and it is comfortable."	Get Fit	Health	Brisk	Burn Some Calories		Long

\*Amount of Calories Burned    \*\*Amount of Fuel Burned

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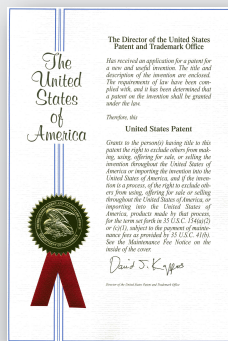
## Threshold Training System

<b>THE THRESHOLD TRAINING SYSTEM®</b>						
Zone Number	Zone Name	Zone Description	Zone Calories Burned/minute	Zone Sustainable Workout Time	Training Load* Points/Minute	Zone Benefits
<b>5</b>	<b>Very Hard Zone</b>	High, hot, hard effort "I don't want to and can't talk" Feels near shut and increasingly uncomfortable	> 15 calories	15 seconds ~ 40 minutes	4-8-10 points**	Get Fastest
<b>T2 HIGH THRESHOLD</b>						
<b>4</b>	<b>High Moderate Zone</b>	Moderate and challenging effort "I can talk but becoming not comfortable" Feels like effort is becoming unsustainable	10-14 calories	40 minutes ~ 2 hours	4 points	Get Fast
<b>3</b>	<b>Low Moderate Zone</b>	Moderate effort "I can talk conversationally" Feels the first shift in my breathing effort	7-9 calories	1-3 hours	3 points	Get Fitter
<b>T1 LOW THRESHOLD</b>						
<b>2</b>	<b>Zone Sustainable Workout Time</b>	Easy effort "I can talk and it is comfortable." Feels comfortable-enjoyable	4-6 calories	Very, very long time	2 points	Get Fit
<b>1</b>	<b>Low Easy Zone</b>	Very easy effort "I can talk and it is easy." Feels almost effortless	1-3 calories	Long-lasting	1 point	Get Healthy

<b>MAXIMUM HEART RATE</b>		<b>HEART ZONES TRAINING</b>																	
Training Zone (% maximum heart rate)	Fuel Burned	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR	Max HR
<b>Z5 RED LINE</b> 90%-100%		160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	
		144	149	153	158	162	167	171	176	180	185	189	194	198	203	207	211	216	
<b>Z4 THRESHOLD</b> 80%-90%		144	149	153	158	162	167	171	176	180	185	189	194	198	203	207	211	216	
		128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188	192	
<b>Z3 AEROBIC</b> 70%-80%		128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188	192	
		112	116	119	123	126	130	133	137	140	143	147	151	154	158	164	165	168	
<b>Z2 TEMPERATE</b> 60%-70%		112	116	119	123	126	130	133	137	140	143	147	151	154	158	164	165	168	
		96	99	102	105	108	111	114	117	120	123	126	129	132	135	138	141	144	
<b>Z1 HEALTHY HEART</b> 50%-60%		96	99	102	105	108	111	114	117	120	123	126	129	132	135	138	141	144	
		80	83	85	88	90	93	95	98	100	103	105	108	110	113	115	118	120	

■ amount of fat burned  
■ amount of carbohydrates burned

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Note: Heart Zones Threshold/ZONING is the only US patent ever awarded a cardio training system

# ZONING<sup>®</sup>

## FITNESS IN A BLINK

Zones	Effort	Zoner	Talk Test	Benefit	Wellness Zones	Activity	Calories Burned	*Fuel Burned	Time In Zones
Red	Hard		"I can't talk comfortably."	Get Fast	Performance	All-Out Effort	Burn More Calories		Short
Yellow	Moderate		"I can talk but it is not comfortable."	Get Fitter	Fitness	Endurance	Burn Lots of Calories		Most of Your Time
Blue	Easy		"I can talk and it is comfortable."	Get Fit	Health	Brisk	Burn Some Calories		Long

\*Amount of Carbohydrates Burned    \*Amount of Fat Burned

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Your Ambient Heart Rate:

bpm

# Lesson #1

## 3 Easy Steps of ZONING

- **5-20-5 Step:**  
*This is the **Timing Rule**.*
- **Blue-Yellow-Red Step:**  
*This is the **Effort Rule**.*
- **Change-It-Up Step:**  
*This is the **Variety Rule**.*

 <b>FITNESS IN A BLINK</b>									
Zones	Effort	Zoner	Talk Test	Benefit	Wellness Zones	Activity	Calories Burned	*Fuel Burned	Time In Zones
Red	Hard		"I can't talk comfortably."	Get Fast	Performance	All-Out Effort	Burn More Calories		Short
Yellow	Moderate		"I can talk but it is not comfortable."	Get Fitter	Fitness	Endurance	Burn Lots of Calories		Most of Your Time
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# Lesson #2. Recovery Heart Rate Assessment

- A measurement of how much your heart rate drops in 60 seconds.
- The higher the recovery number, the fitter your cardiac muscle.
- A high recovery number indicates a healthy training status.
- A high recovery number means you have permission for a hard workout.

Step	Recovery Heart Rate Activity
Step 1.	Do any vigorous and acceptable physical movement that raises heart rate for 1 minute. Note the peak heart rate minute (A) at the end of 1 minute.
Step 2.	Take a comfortable position and rest for 1 minute noting the final heart rate number (B) at the end of one minute (60 second heart rate after rest).
Step 3.	Subtract 60 second rest number (B) from peak heart rate number (A) to determine your recovery heart rate number.



# Recovery Heart Rate Results

SCORECARD			
TARGET HEART RATE BPM (A)	BPM END OF 1 MINUTE (B)	=	RECOVERY HEART RATE (C)
_____ bpm	_____ bpm	=	_____ bp m

YOUR Scorecard		
Recovery Heart Rate Test	Your Recovery heart rate number :  _____ bpm	<10 Extreme caution 11-20 Low 21-40 Good 41-50 Excellent >50 Fit Athlete



# What Affects Heart Rate Numbers

## Factors that Affects Your Heart Rate Number:

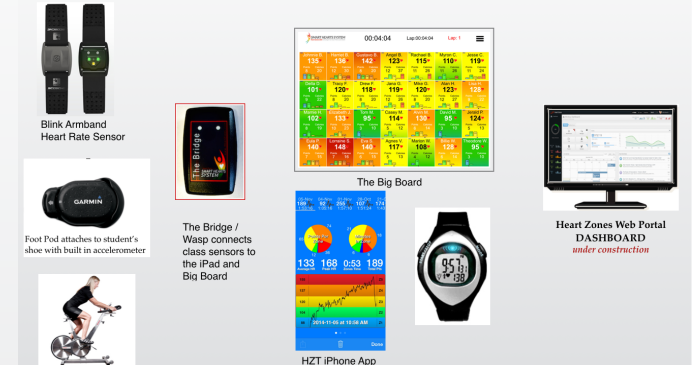
- ✓ Stress
- ✓ Temperature
- ✓ Perspiration
- ✓ Dehydration
- ✓ Emotions
- ✓ Hormones
- ✓ Fitness Level
- ✓ Phobias / Fears
- ✓ Breathing
- ✓ Caffeine / Stimulants
- ✓ Diet Pills
- ✓ Certain Medications
- ✓ Illness / Fever
- ✓ Pregnancy
- ✓ Various Medical Conditions
- ✓ Sleep / Fatigue
- ✓ Time of Day
- ✓ Music





# Lesson #3 The Technology

- Tool Based Digital Training
- Types of Heart Rate Monitor “Sensors”
- 3 Types of Transmission
- Reasons to Use
  - Heart Rate (Zones and BPM)
  - Step Trackers Not Activity Tracker
  - Cycling Speed & Distance & Power



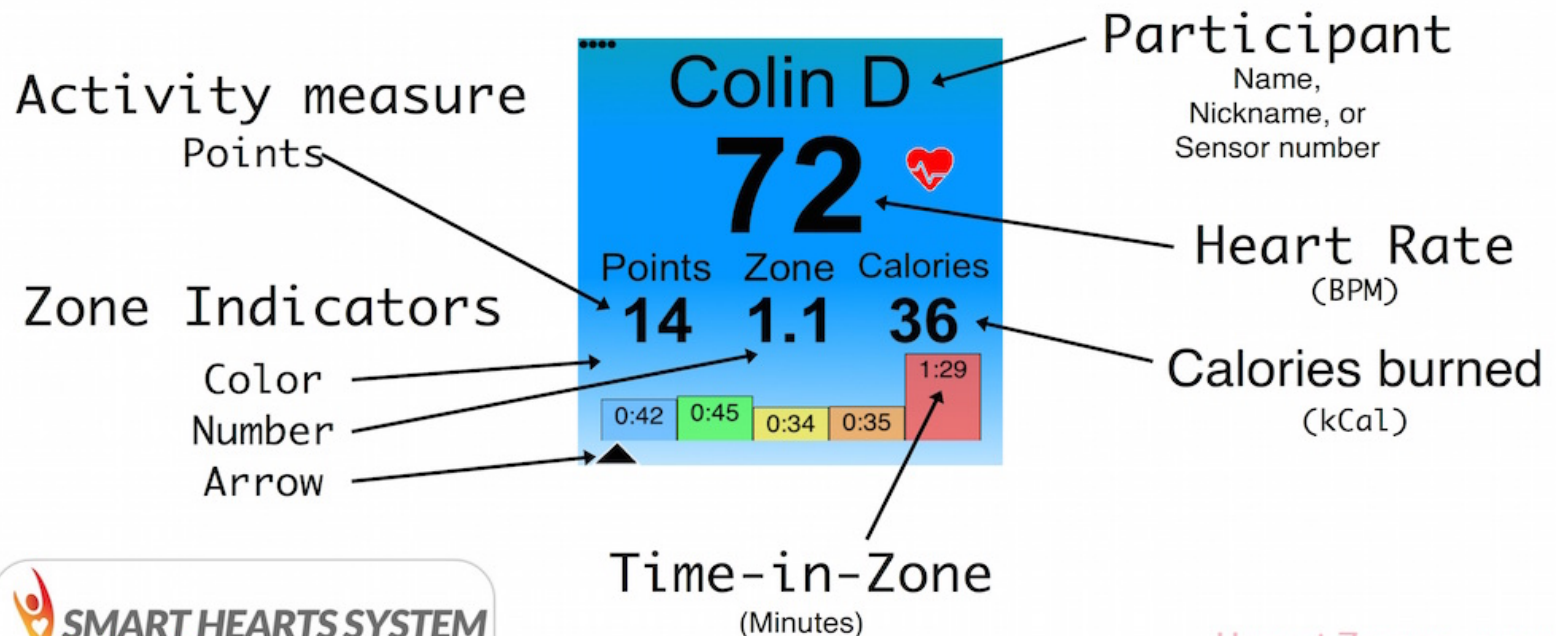
## Reasons Why the Heart Zones System is So Great:

1. Open versus Closed system
2. Robust Data individual
3. Expandable as new sensors develop and “future forward”
4. Wireless both indoor and outdoors
5. Progressive curriculum: K-12



# Lesson #4. The Data: Heart Rate

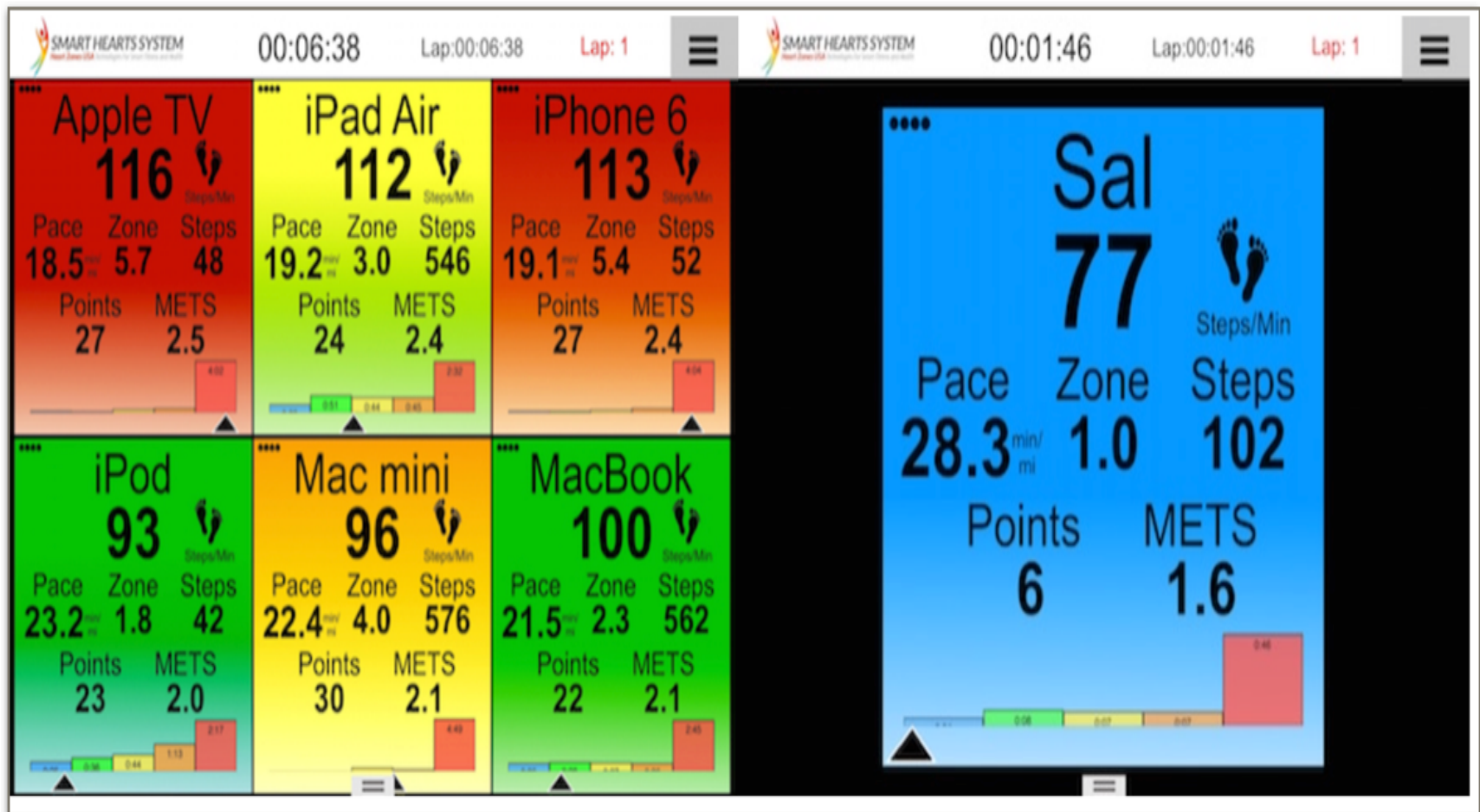
## Heart Rate Display



HeartZones.com



# The Data: Step Trackers





# Activity: Get 50 Points

- Set up a minimum of 6 different cardio-circuit stations\*
- Put on a foot pod
- Have each participant spend 1 minute at each station.
- Fill out the Worksheet Below for each station
- Modify the activity if you have more time to 100-150 Points.
- Answer the question: **Which station did I get the most Points?**

## Get 50 Points on the Big Board

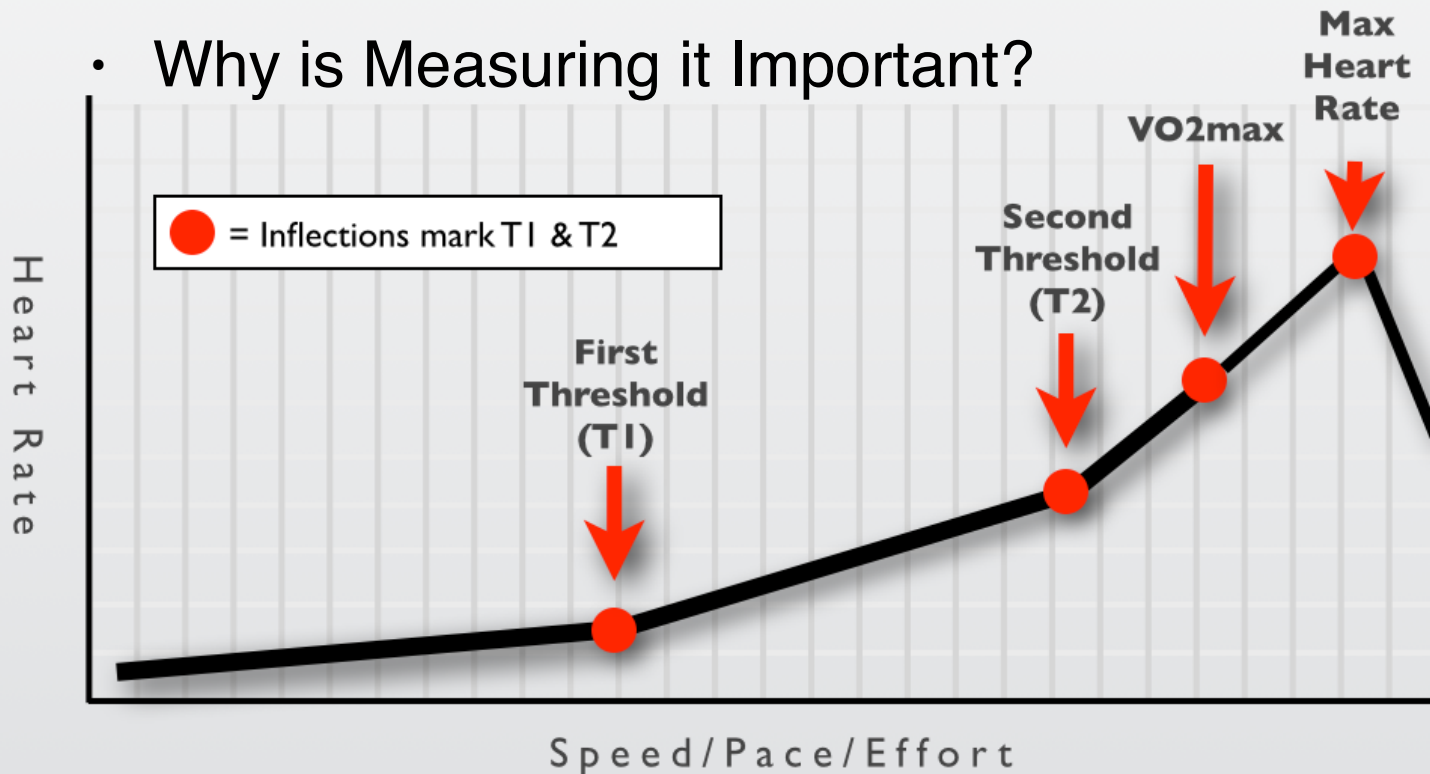
Station 1.	_____Points
Station 2.	_____Points
Station 3.	_____Points
Station 4.	_____Points
Station 5.	_____Points
Station 6.	_____Points

\* Teacher chooses stations: Jump rope, steps, shuttle, jumping jacks, weaves, etc.

# Lesson #5.

## ZONING: 2 Threshold & 3 Zones

- Definitions: T1 and T2
- How to Detect the Two Thresholds
- Why is Measuring it Important?





# The Two Thresholds

Zones	Effort	Zone	Task Test	Benefits	Wellness Zones	Activity	Calories Burned	*Fuel Burned	Time in Zones
Red	Hard		"I can't talk comfortably."	Get Fast	Performance	All Out Effort	Burn More Calories		Short
Yellow	Moderate		"I can talk but it's not comfortable."	Get Fitter	Fitness	Endurance	Burn Lots of Calories		Most of Your Time
Blue	Easy		"I can talk and it's comfortable."	Get Fit	Health	Break	Burn Some Calories		Long

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- Threshold heart rates are *dynamic*. They change.
- Threshold heart rates are sport specific.
- Threshold heart rates are a predictors of performance.
- Threshold heart rates do not decline with age.
- Threshold heart rates decline with declining fitness.
- Threshold heart rates cannot be accurately predicted by *any* mathematical formula.
- Threshold heart rates go up with optimum training and go down with overtraining.
- **Threshold occurs at two points: Low T1 and High T2**





Your Ambient Heart Rate:

\_\_\_\_\_ bpm

# Lesson 6: How to Detect T1 and T2

Different Ways To Detect T1 and T2:

- Mathematical formulas are worthless
- Field tests more accurate
- Lab tests the most accurate



Carl Foster, Ph. D  
metabolic lab test - MHZT,  
Kathy Kent



Lactate testing tool used to  
analyze blood lactate levels.



# Activity 2. T1 Assessment



## "Can You Speak Comfortably?" Foster Threshold Field Test

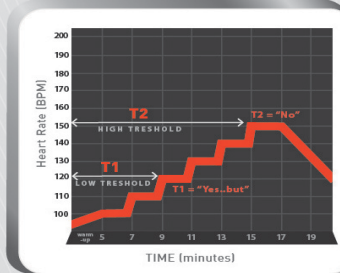


**Purpose:** The purpose of this test is to help you measure your low (T1) and high (T2) threshold heart rate numbers to use during your HZT, Heart Zones Training workouts.

**Description:** This assessment has you identify shifts in your breathing, or ventilatory response -- i.e., your breathing rate and exertion during your recitation of a short phrase at increasingly elevated heart rates -- during the assessment-- to establish your low threshold (T1) and high threshold (T2) numbers.

- STEP 1** Select a cardio activity and warm-up adequately for about 5 minutes.
- STEP 2** Starting at a heart rate of 110 bpm, progress through a series of 2-minute test stages, increasing your heart rate by 10 bpm in each stage.
- STEP 3** During each stage recite out loud the "Pledge of Allegiance" or another verse of similar length. After reciting this short verse aloud, answer the question "Can You Speak comfortably?"
- STEP 4** There are three answers to this question: "Yes," "Yes, but...." or "No". At the end of each 2-minute stage, circle on the Scorecard your answer at this stage.
- STEP 5** Continue to move through the stages increasing your effort 10 bpm every 2 minutes until you answer the question "Can You Speak Comfortably?" with a "No". Stop the test and cool down adequately.
- STEP 6** Score the results on the Scorecard by circling the heart rate number that matches this description for T1 and T2:
  - T1 is the heart rate the first time you answer the question with a "Yes, but...."
  - T2 is that heart rate number when you answer the question "No".

"Can You Speak Comfortably?" Foster Threshold Field Test



## SCORECARD

"Can You Speak Comfortably?" Foster® Threshold Field Test



At the end of each 2-minute stage, circle in Column (B) the words that best answer the question: "Can You Speak Comfortably?" Scoring: Low threshold, T1, is the heart rate number where you first circled "Yes, but...." and high threshold, T2, is the heart rate number where you circled "No".

Stage	Heart Rate Number (A) (BPM)	Time (minutes)	"Can You Speak Comfortably?" (B)		
Warm-Up	100 bpm	0-5 min	Yes	Yes, but...	No
1	110 bpm	5-7 min	Yes	Yes, but...	No
2	120 bpm	7-9 min	Yes	Yes, but...	No
3	130 bpm	9-11 min	Yes	Yes, but...	No
4	140 bpm	11-13 min	Yes	Yes, but...	No
5	150 bpm	13-15 min	Yes	Yes, but...	No
6	160 bpm	15-17 min	Yes	Yes, but...	No
7	170 bpm	17-19 min	Yes	Yes, but...	No
8	180 bpm	19-21 min	Yes	Yes, but...	No

\*This test is named after Carl Foster, Ph. D. who created and validated this test.  
Carl Foster, PhD, John P. Porcari, PhD, et al. The Talk Test as a Marker of Exercise Training Intensity. Journal of Cardiopulmonary Rehabilitation and Prevention 2008; 28:24-30

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## **3 Answers to Field Test Question**

The Can You Speak Comfortably Foster  
Threshold Field Test:

**Can you talk comfortably? Only three answers -**

“Yes”

“Yes, but...”

or

“No”



# **The Pledge of Allegiance**

The “Can You Speak Comfortably” Foster  
Threshold Field Test

## **The Pledge Allegiance:**

**“I pledge allegiance to the flag  
of the United States of America,  
and to the republic for which it stands,  
one nation, under God, indivisible,  
with liberty and justice for all.”**



# Lesson #7. Ambient Heart Rate Assessment

- Definition: The number of bpm when seated and relaxed. Ambient heart rate is a measure of relative emotional stress.
- Measures: Relative physical stress and recovery.
- Affected by internal and external conditions:
  - Temperature
  - Medication
  - Training status
  - Foods—stimulants such as caffeine and depressants such as alcohol.
  - Amount and quality of sleep and other daily activities.

**Your Ambient Heart Rate:**

\_\_\_\_\_ bpm



# Lesson #7 Ambient Heart Rate Assessment

**Activity:** Take the Ambient Heart Rate Assessment

## Ambient Heart Rate Fitness Test<sup>®</sup>

A lower ambient heart rate can indicate a lower stress level and a fitter heart muscle.

- STEP 1** Sit quietly for five minutes.
- STEP 2** For 5 minutes, relax and record your heart rate every 60 seconds, which is 5 recordings.
- STEP 3** Average your five recordings.
- STEP 4** Your ambient heart rate is the average of these five recordings.
- STEP 5** Record your results.

HEART ZONES   
©Heart Zones 2005

## Ambient Heart Rate Fitness Test<sup>®</sup>

BPM	BPM	BPM	BPM	BPM
1 MINUTE	2 MINUTE	3 MINUTE	4 MINUTE	5 MINUTE

AVERAGE AMBIENT HEART RATE

=

BPM





## Student Worksheet 1.2

### Using the Blink Armband Heart Rate Sensor to Measure Ambient Heart Rate

Name \_\_\_\_\_ Date \_\_\_\_\_ Ambient HR \_\_\_\_\_

Review definition of Ambient heart rate

Right now, my ambient heart rate is \_\_\_\_\_ (A).

Wait 60 seconds and take a second reading.

Right now, my ambient heart rate is \_\_\_\_\_ (B).

To find your average ambient heart rate:

$$A + B = C \text{ (sum of the heartbeats)}$$

$$\text{Average} = (\text{sum of the heartbeats}) \text{ divided by } 2 \text{ (the number of readings)}$$

Find and record your average ambient heart rate (show your work here).

My average ambient heart rate for today is \_\_\_\_\_ bpm.

Ambient Heart Rate Number





# Lesson #9. All About Zones

- Threshold Zones are dynamic.
- Thresholds Zones have weight.
- Threshold Zones are linear to T1
- Threshold Zones are curvilinear to T2
- Threshold Zones are exponential after T2

Zones	Effort	Zoner	Talk Test	Benefit	Wellness Zone	Activity	Calories Burned	*Fuel Burned	Time In Zones
Red	Hard		"I can't talk comfortably."	Get Fit	Performance	All-Out Effort	Burn More Calories		Short
Yellow	Moderate		"I can talk but it is not comfortable."	Get Fitter	Fitness	Endurance	Burn Lots of Calories		Most of Your Time
Blue	Easy		"I can talk and it is comfortable."	Get Fit	Health	Brisk	Burn Some Calories		Long

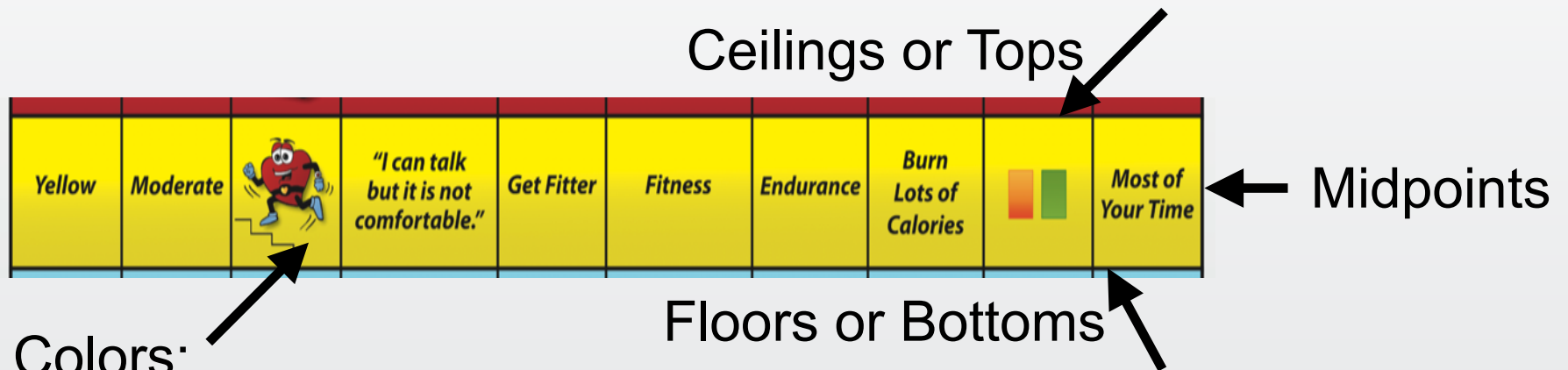
**T2** (Transition between Red and Yellow)

**T1** (Transition between Yellow and Blue)

\*Amount of Carbohydrates Burned    \*Amount of Fat Burned

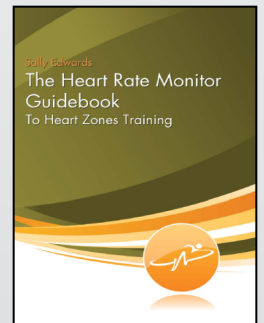


# The Parts of a Zone



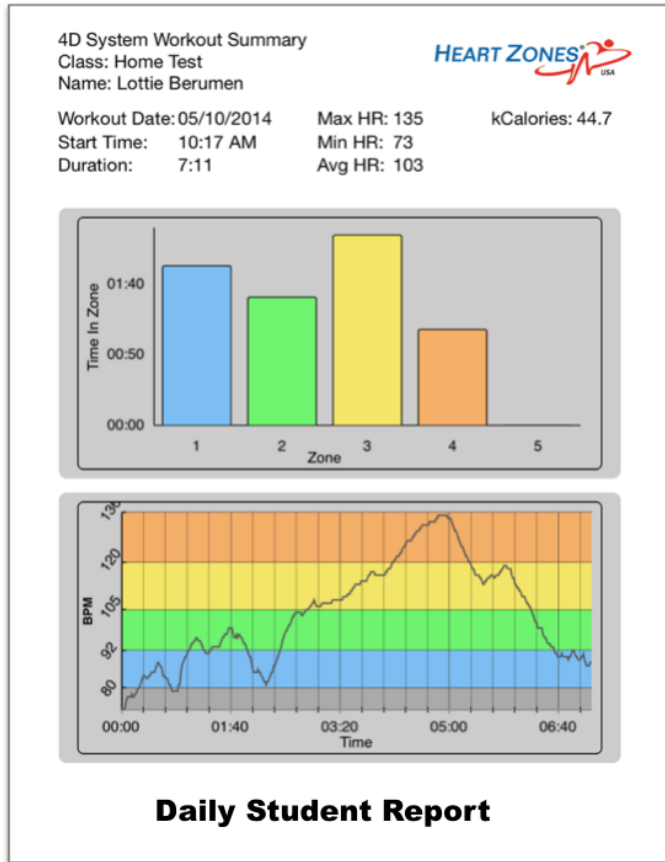
Colors:

- Blue
- Yellow
- Red





# Lesson #10. Grading





# Threshold ZONES CHART:

## Secondary Schools

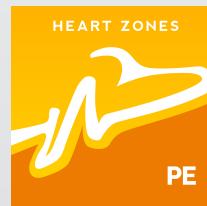
<div> <div>HEART ZONES<sup>®</sup> TRAINING</div> <div>The Threshold Training System<sup>®</sup></div> <div>ZONES CHART</div> <div>CYCLING FUSION</div> </div>						
Zone Number	Zone Name	Zone Description	Zone Calories Burned/minute	Zone Sustainable Workout Time	Training Load* Points/Minute	Zone Benefits
<b>ZONE 5</b>	Very Hard Zone	High, hot, hard effort "I can't talk comfortably." Feels near max	> 15 calories	15 seconds - 40 minutes	6-8-10 points**	Get Fastest
T2 HIGH THRESHOLD						
<b>ZONE 4</b>	High Moderate Zone	Hard strong effort "I can talk but it is not comfortable." Feel shift in breathing rate	10-14 calories	40 minutes - 2 hours	4 points	Get Fast
<b>ZONE 3</b>	Low Moderate Zone	Moderate effort "I can talk conversationally." Feels sustainable	7-9 calories	1-3 hours	3 points	Get Fitter
T1 LOW THRESHOLD						
<b>ZONE 2</b>	High Easy Zone	Easy effort "I can talk and it is comfortable." Feels comfortable-enjoyable	4-6 calories	Very, very long time - possibly "all day"	2 points	Get Fit
<b>ZONE 1</b>	Low Easy Zone	Very easy effort "I can talk and it is easy." Feels almost effortless	1-3 calories	Long-lasting	1 points	Get Healthy
<small>*Training load is the amount of exercise stress or dosage measured using a point system; multiply the number of minutes in the zone by the training load points for that zone and this equals the total training load for that session. Load-Frequency x Zone Points x Minutes = Heart Zones Training Points or HZT Points. Copyright Heart Zones USA 2536 Fulton Avenue, Sacramento, CA USA <a href="http://www.HeartZones.com">www.HeartZones.com</a> <a href="http://www.cyclingfusion.com">www.cyclingfusion.com</a></small>						
<small>** 4 Points for the bottom of Zone 5, 8 Points for the middle of Zone 5, 10 Points for the top of Zone 5.</small>						



# Thank You



**Deb Van Klei and Sally Edwards**







# Appendix A: The Patented Threshold Training System

- **Heart:** A double action muscle that is the source of our emotional, metabolic, and physical health.
- **Zones:** A range of heartbeats.
- **Threshold:** a shift or change in physiological bio-markers – oxygen, blood lactate, ventilatory.
- **Training:** A systematic way of performing physical activity that leads to accomplishing goals.

Awarded to Heart Zones USA January 2012. The only cardiovascular training system ever to be awarded a US federal patent.





## Appendix B. Facts about HZT



- HZT, Heart Zones Training using maximum heart rate was **first** released in 1992 with the publication of the book *The Heart Rate Monitor Book* by Sally Edwards.
- HZ Threshold Training System first released in 2006 with the publication of the book *Heart Zones Cycling*.
- **HZT is the original heart-rate training system using zones.**
- HZT is the “standard” and accepted methodology for training using zones and a heart rate monitor.
- HZT is used with schools, teams, coaches, group training personal training, weight loss, and individual athletes.
- HZT is core cardiovascular training for any activity.