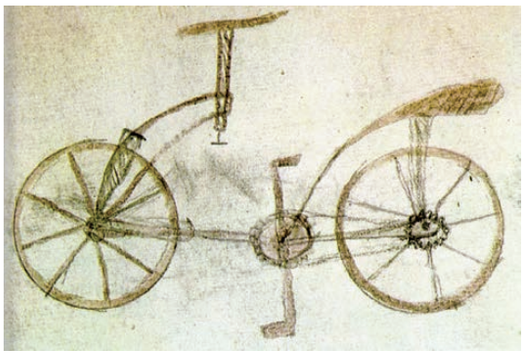
The History of the Bicycle

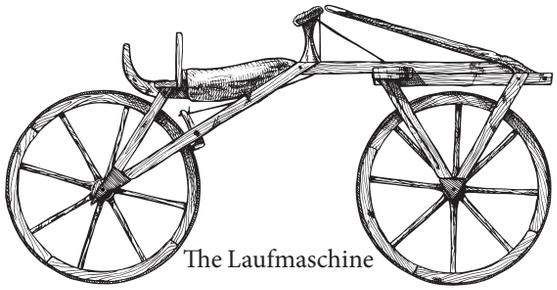
The 'Dandy-horse.'

The look and feel of the first bikes were significantly different from today's modern versions, styles, and capabilities. One of the earliest designs came from Leonardo da Vinci in 1493, this sketch showed a simplistic style and framework. The popular method of



transportation at this time was horse and buggy, because da Vinci's design was ahead of its time and essentially dismissed. It would be decades later before the composition and design closely resembled the bikes of today.

The first model of a bicycle was created by a German inventor named Baron Karl von Drais in 1817. This bike was called the **"Laufmaschine"** and consisted of two wheels held together by a bar in the middle of the bike. The functionality of this bike was not ideal, as it took physical effort and strength to effectively ride the bike. Riders had to walk or run beside the bike to generate speed, then raise their legs onto the bike, and cruise until there was no more momentum to glide. This design was also



The Laufmaschine

dangerous as it lacked the ability to steer or brake. This design was used for close to 40 years, but was eventually improved upon and called the "Dandy Horse".

The **"Dandy Horse"** design was created by two French carriage makers named Pierre Michaux and Pierre Lallemen. Their expertise and knowledge led them to formulate a plan to integrate pedals as part of the front wheel, including the addition of a mounted seat to the support beam.

By the mid-1860s, the production of this design was considered to be relatively straightforward to produce, and in turn, the model was mass produced. The production

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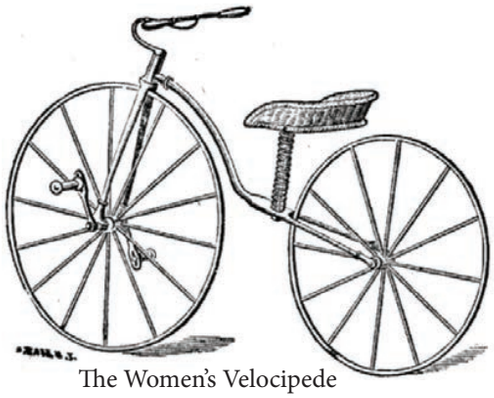
also led to creating an improved model that was more comfortable. It included iron (not wood), rubber tires, and ball bearings. It was also around this time, in the 1870s, that the first "high wheel" model was created by Eugene Meyer and eventually mass produced by James Kemp Starley. The model had a large front wheel and provided even more comfort and a faster ride due to a lighter frame. This model was well-received by many riders, the only real challenge was riding up and down hills.



The Women's Velocipede

The high wheel bike was very popular for its few years of existence, yet safety was an essential adaptation the bicycle needed. Because of this, Starley developed the first "safety bicycle"; today this remains to be one of the most influential moments in the history of bikes. The bicycle would feature components we see in today's bicycles, such as: chain-to-pedals-to-the-rear-wheel and the ability to steer the front wheel; also known as the **"Rover"** device.

This configuration in safety and handling created the era known today as the "Golden Age of Bicycles". Appropriately, this model and equipment was the standard across the globe, as it fulfilled the four essential needs of safety, speed, comfort, and steering. The design featured a diamond-like shape at the center of the bike, surrounded by pneumatic rubber tires, a roller chain, one gear, and coaster brakes as the primary materials and composition.

The "Golden Age" spanned from 1900 - 1950. Bicycles were considered a primary means of transportation during this time. Bicycle clubs also became popular with many cyclists riding across both the United States and Europe. Due to this popularity, manufacturing costs decreased which increased the use across the globe.

By the 1960s and 1970s, the modernization of bicycles began to really take shape in the U.S. with a focus around exercise and transportation that could conserve energy. By 1975, over 17 million riders could be seen driving on a much lighter and inexpensive bike. This would eventually lead to the development of bikes that can navigate on a variety of surfaces, such as street racing, hitting the trails and rocky terrain, or dirt with several sharp curves to navigate.

The most recent and significant update over the last decade has included "hybrid commuter bikes" – a combination of speed and mountain bike – constructed using aluminum and carbon fiber (composite) for maximum performance, as opposed to iron used for many years to manufacture the bicycle. From the mountain bike to the beach cruiser, there is fundamentally not a bike used today inspired from the first style and framework.

Source: http://www.bicyclehistory.net/bicycle-history/history-of-bicycle/

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Beach Cruiser

10-Speed

Mountain Bike

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Module 1.0

Name: _____ Class: _____

The STEM Bike

GRADES 6-8

Elaborate

1. What were some constraints of the first bicycles? Why do you think cyclists/riders felt they needed to make a change?

2. How has the structure of the bicycle changed over time? What drove this change?

3. How have the materials and shape of the bicycle changed over time? How do you think these advancements impacted cyclists/riders?

4. What was the purpose of this article? Provide evidence from the text to support your claim.

5. Do you think there will be future changes to the bicycle? If so, what changes do you foresee being made and why?

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Name: _____ Class: _____

The STEM Bike

GRADES 6-8

Evaluate

Complete the following criteria and constraint table using information from the article and classroom discussion.

Criteria	Constraints

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Name: _____ Class: _____

Ideal Pressure for Balance

GRADES 6-8

Elaborate

Trial	Tire Feel	Tire Pressure (psi)	Time to Ride (100 ft) Seconds
1	Under-inflated	15 psi	
2	Properly-inflated	30 psi	
3	Over-inflated	45 psi	

Which tire pressure had ideal balance and performed the best? _____

Evaluate

Draw a diagram at a molecular level of what would happen to a tire on a winter day and summer day.

Winter Day	Summer Day

How does temperature affect a tires behavior and performance? Explain using reasoning and evidence from observations and experimental data.

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Name: _____ Class: _____

What's your Angle?

GRADES 6-8

Explore

Rear Triangle	24" STEM Bike (cm)	Front Triangle	24" STEM Bike (cm)	Rear Triangle	Angle Measure (Degrees)	Front Triangle	Angle Measure (Degrees)
Tire to Pedal		Seat to Handlebar		Tire		Tire	
Seat to Pedal		Seat to Pedal		Pedal		Pedal	
Tire to Seat		Pedal to Handlebar		Seat		Seat	

Explain

	Triangle Inequality Theorem	Triangle Sum Theory
Rear Triangle		
Front Triangle		

Elaborate

What do you expect the angle measures and bike measures to be on the 26" bike? Provide specific predictions.

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Module 3.0

Name: _____ Class: _____

What's your Angle?

GRADES 6-8

Evaluate

Rear Triangle	26" STEM Bike (cm)	Front Triangle	26" STEM Bike (cm)	Rear Triangle	Angle Measure (Degrees)	Front Triangle	Angle Measure (Degrees)
Tire to Pedal		Seat to Handlebar		Tire		Tire	
Seat to Pedal		Seat to Pedal		Pedal		Pedal	
Tire to Seat		Pedal to Handlebar		Seat		Seat	

Explain

	Triangle Inequality Theorem	Triangle Sum Theory
Rear Triangle		
Front Triangle		

Are the measurements from the 24" and 26" bike proportional?
Justify your response with an example. _____

Extend

24" Bike Frame	26" Bike Frame

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Module 4.0

Name: _____ Class: _____

Heart Rate and Calories

GRADES 6-8

Engage/Explore

	Partner 1	Partner 2
Resting Heart Rate (measured)		
Maximum Heart Rate (calculated)		
Heart Rate (15 seconds peddling)		
Heart Rate (30 seconds peddling)		
Heart Rate (45 seconds peddling)		
Heart Rate (60 seconds peddling)		
Heart Rate (75 seconds peddling)		
Heart Rate (90 seconds peddling)		

Explain/Elaborate

Weight in Kilograms = _____

Use the resting MET of 1.5 to calculate the total number of calories burned.

	C = (MET * weight) * t	Calories Burned C
5 minutes = _____ hours		
10 minutes = _____ hours		
15 minutes = _____ hours		
20 minutes = _____ hours		
25 minutes = _____ hours		
30 minutes = _____ hours		

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Name: _____ Class: _____

Heart Rate and Calories

GRADES 6-8

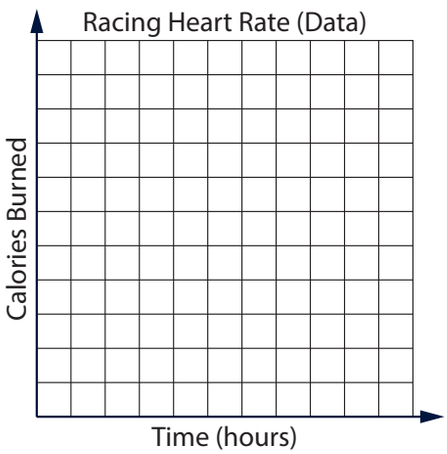
Evaluate

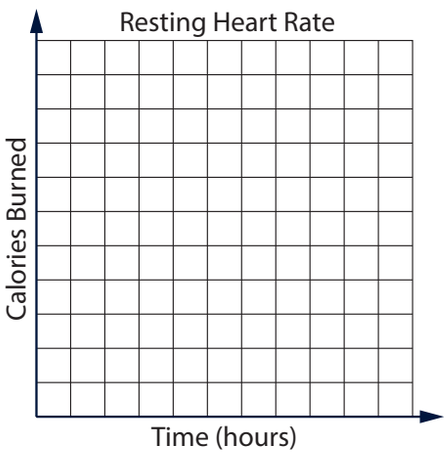
Use the racing MET of 7.3 to calculate the total number of calories burned.

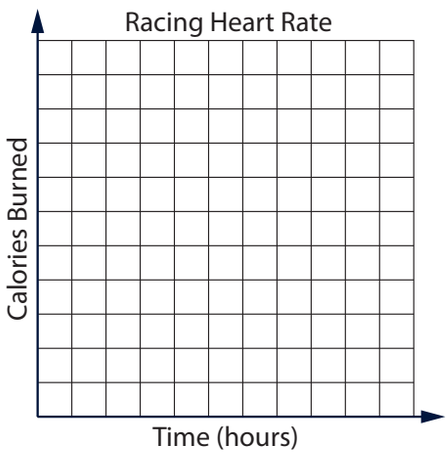
Time of Activity (hours) t	C = (MET * weight) * t	Calories Burned C
5 minutes = _____ hours		
10 minutes = _____ hours		
15 minutes = _____ hours		
20 minutes = _____ hours		
25 minutes = _____ hours		
30 minutes = _____ hours		

Extend

Use the values from the function tables in *Elaborate* and *Evaluate* to graph.







How do the slopes of the graphs compare? _____

_____

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Module 5.0

Name: _____ Class: _____

Changing Gears

GRADES 6-8

Explain/Elaborate

Mass of the bike and rider (in kilograms) = _____
Record the time it took to ride 20 meters using gear 1.

Distance 20 m	Time (seconds)	Velocity (distance/time)	Acceleration (velocity/time)	Force (mass * acceleration)
Ride 1				
Ride 2				
Ride 3				

Predict: How do you think your acceleration will compare when using gear 3?

_____

_____

Predict: How do you think your force will compare when using gear 3?

_____

_____

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Name: _____ Class: _____

Changing Gears

GRADES 6-8

Explore

Mass of the bike and rider (in kilograms) = _____
Record the time it took to ride 20 meters using gear 3.

Distance 20 m	Time (seconds)	Velocity (distance/time)	Acceleration (velocity/time)	Force (mass * acceleration)
Ride 1				
Ride 2				
Ride 3				

Mass of the bike and rider (in kilograms) = _____
Record the time it took to ride 20 meters using gear 5.

Distance 20 m	Time (seconds)	Velocity (distance/time)	Acceleration (velocity/time)	Force (mass * acceleration)
Ride 1				
Ride 2				
Ride 3				

Make a claim for how the gear change affected the speed and force you were able to pedal.

_____

_____

Extend

What one variable are you going to change when designing your own controlled experiment?

_____

_____

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Module 6.0

Name: _____ Class: _____

Helmet Technology

GRADES 6-8

Engage

I noticed...	I wonder...	I think...

Explain

Criteria	Constraints
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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Module 6.0

Name: _____ Class: _____

Helmet Technology

GRADES 6-8

Elaborate

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Name: _____ Class: _____

Energy of the Ride

GRADES 6-8

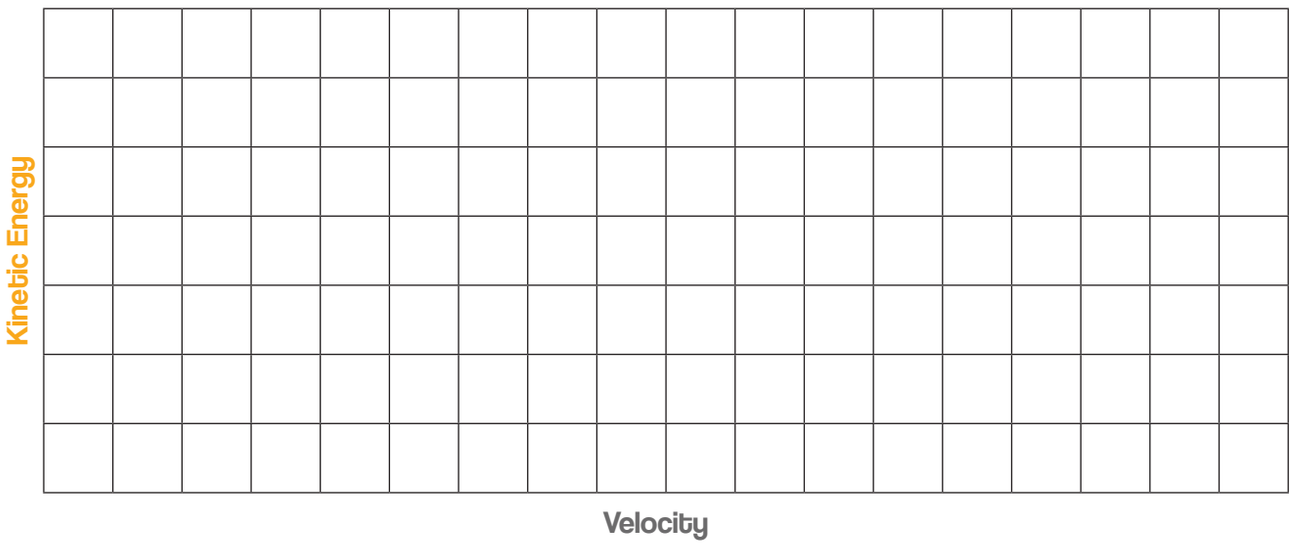
Explore

What percent of the Denise Mueller-Korenek (183 MPH / 82 meters/second) was your fastest ride? Example: If you rode at 10 M/S / 82 M/S = .12 or 12%. Your fastest ride was only 12% as fast as Denise Mueller-Korenck's ride.

Elaborate

Ride: 30 meters			
Mass of the bike: 14 kg	**Time (seconds)**	**Velocity (meters/second)**	**Kinetic Energy (Joules)**
Student 1			
Student 2			
Student 3			
Student 4			

Graph the kinetic energy vs. your velocity for each ride from slowest to fastest



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Module 7.0

Name: _____ Class: _____

Energy of the Ride

GRADES 6-8

Evaluate

Based on your data/graph, explain the relationship between velocity and kinetic energy by making a claim about the relationship. Support your claim with evidence and reasoning.

Claim: What is the relationship between velocity and kinetic energy?

Evidence: Record and reference in words any data that supports your claim.

Reasoning: Explain why your claim is supported by evidence and scientific ideas. Use the kinetic energy formula to support you.

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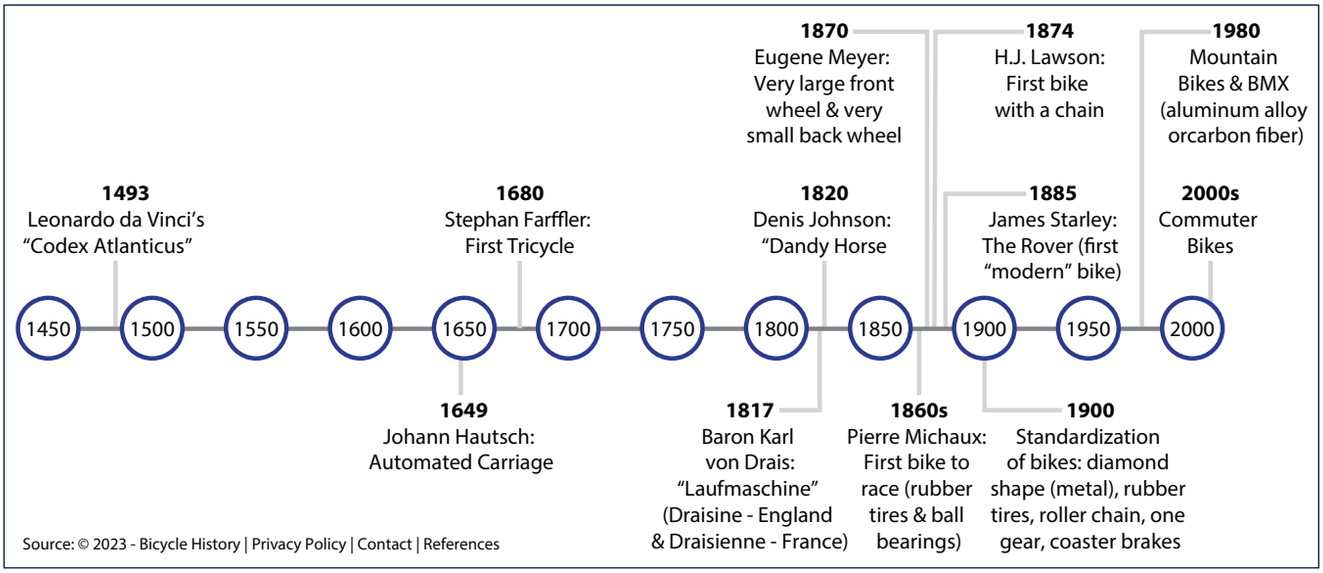
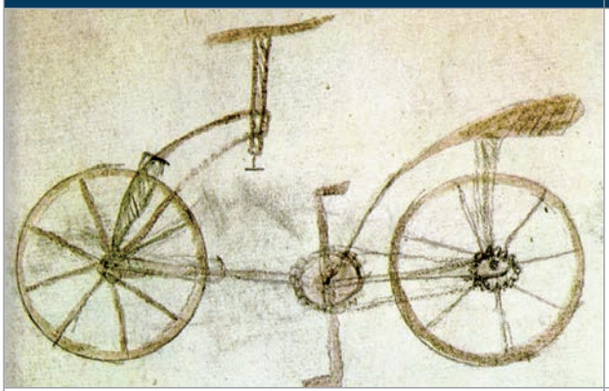
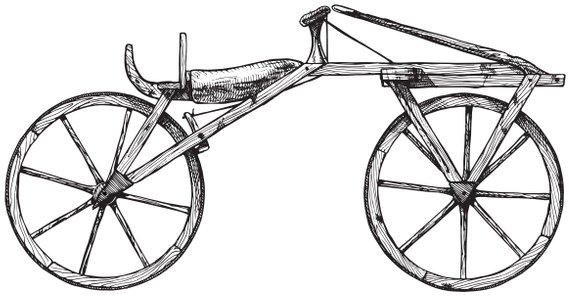
Name: _____ Class: _____

Advancements in Bike Technology

GRADES 6-8



Engage/Explore

Bike	Observations with Numbers	Observations with Words	Inference: Why was there a design change?
			
			

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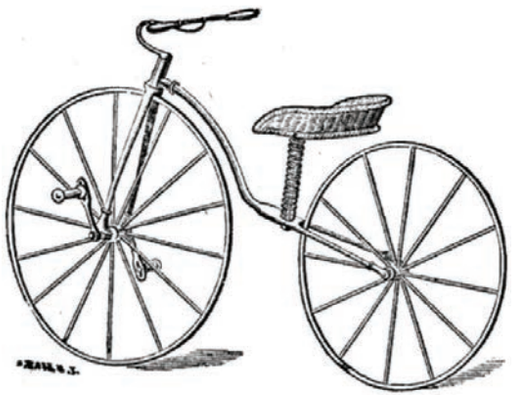
Module 8.0

Name: _____ Class: _____

Advancements in Bike Technology

GRADES 6-8

Engage/Explore

Bike	Observations with Numbers	Observations with Words	Inference: Why was there a design change?
 PHOTO: Copy of an engraving from The Women's velocipede, its history, varieties, and practice by J.T. Goddard, p. 85. (Wikimedia Commons)			

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Module 8.0

Name: _____ Class: _____

Advancements in Bike Technology

GRADES 6-8

Engage/Explore

1. What would you consider the single greatest advancement in bike technology over the last 200 years? Explain.

2. Hypothesize: Why has the bicycle changed more in the last 130 years [1860s - 2000s] than it did in the previous 350+ years [1493 - 1850]?

3. What year do you feel the first bike provided safety features, yet performed well? Explain.

4. There are a variety of bicycles available for purchase, such as the mountain bike, beach cruiser, and 10-speed. What style do you think riders prefer and why?

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Module 8.0

Name: _____ Class: _____

Advancements in Bike Technology

GRADES 6-8

Elaborate

Brainstorm three designs to improve bike technology to prevent injuries and increase performance. Use the image on page 78 to identify and label parts of the bike for safety and performance.

Design 1	
Design 2	
Design 3	

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Name: _____ Class: _____

Advancements in Bike Technology

GRADES 6-8

Evaluate

Select your best design: Use your observations and inferences from the *Explore* and *Explain* sections to justify why your design will prevent injuries and increase performance.

_____

_____

_____

_____

_____

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Stage 1

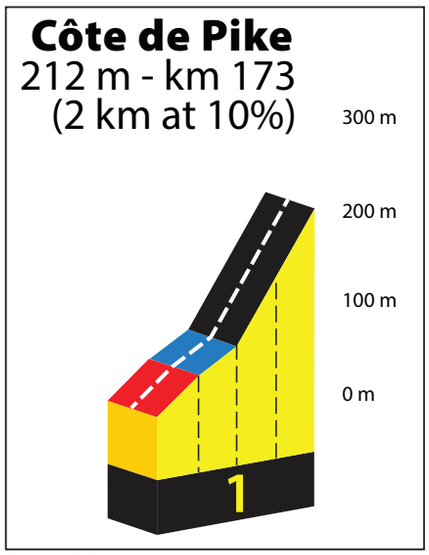


Photo: A.S.O.

Stage 9

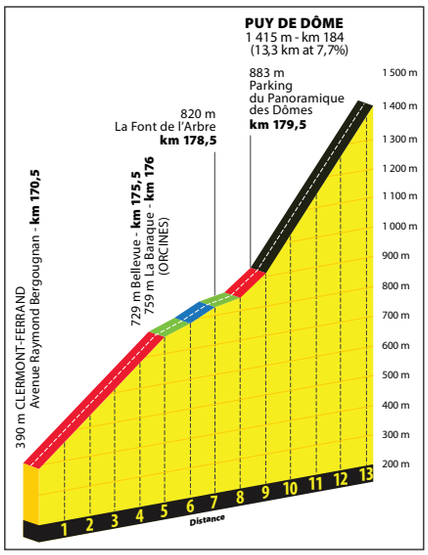
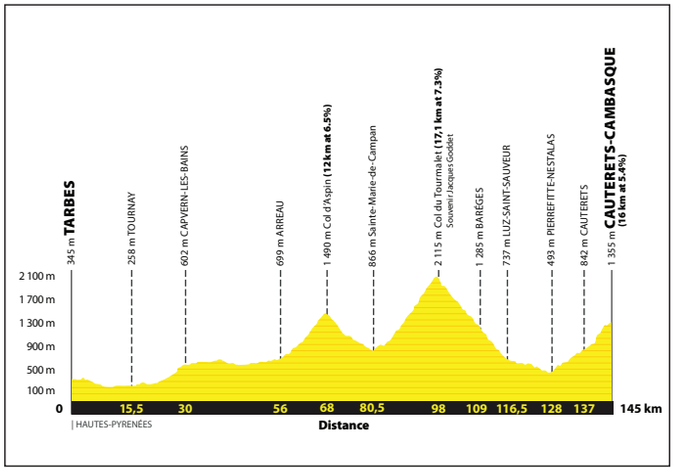


Photo: A.S.O.

Stage 3

Photo: A.S.O.

Stage 6



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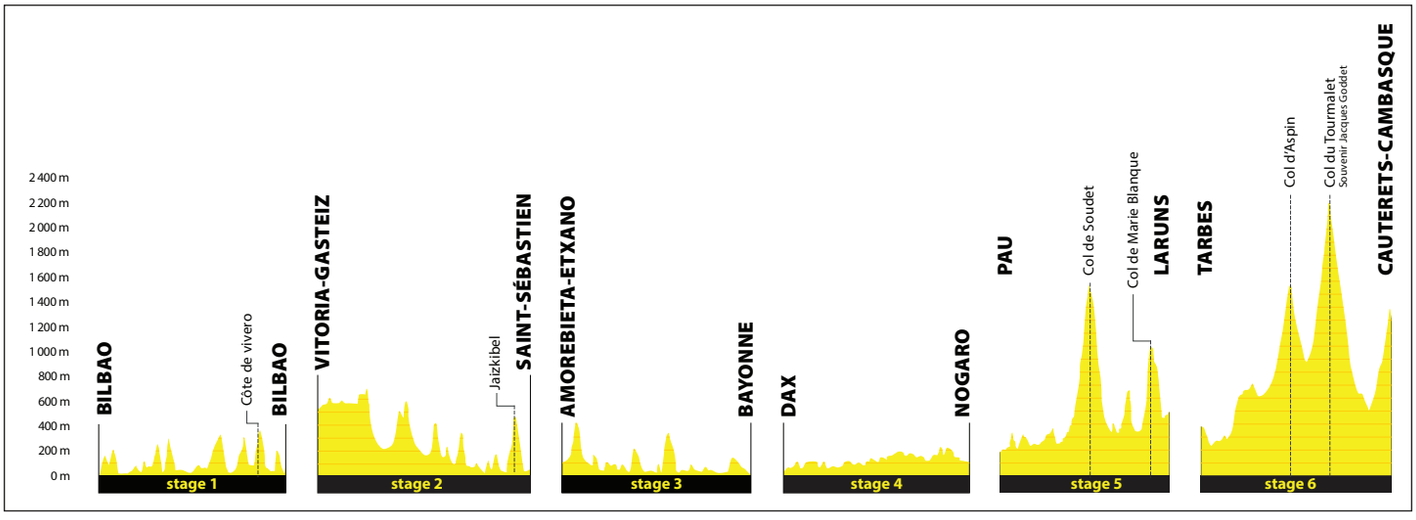
Stages 1-6



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