

# Sandia Peak Aerial Tramway



A Teacher's Guide for Field Trips to the Tram

# Contents:

Overview and History

Planning for a Visit/ What to Prepare

Booking Your Visit

What to Expect

Pre-Visit: Student Informative Handouts

Student Fill in the Blank Activity

Fill in the Blank Answer Sheet

Scavenger Hunt

# Sandia Peak Aerial Tramway

## A TEACHER'S GUIDE FOR FIELD TRIPS TO THE TRAM

### Overview and History of the Sandia Peak Tram

The concept to the Tram was developed in the early 1960's by Robert Nordhaus and Ben Abruzzo, who were the two original pioneers. The Tram has taken more than 11.5 million passengers to the top of Sandia Peak and back again. The 50th anniversary of the Tram was celebrated in May 2016.



Opening Day: May 1966



50<sup>th</sup> Celebration: May 2016

**History:**

The tram took two years to move from idea to construction project. Installing the tram posed considerable problems because of the steep, rocky terrain. Bell Engineering of Lucerne, Switzerland, was contracted for the difficult project.



Tower One, located at an elevation of 7,010 feet, is 232 feet tall. Tower One leans at an 18 degree angle to evenly support the cables between the lower terminal and Tower Two.

Tower Two located at a breathtaking 8,750 feet, is 80 feet tall.

Holes were drilled and steel rods were anchored in the granite (many over 30 feet deep) to secure each of the footings for the towers and terminals of the tram. Keeping the towers in alignment was of major concern and importance.



Tower 1



Tower 2

## Sandia Peak Aerial Tramway

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### Views and Terrain:

Although the Tram is an engineering marvel, visitors come mainly for the spectacular view - 11,000 square miles of the Land of Enchantment. Passengers ascend 4,000 feet in about 15 minutes, gliding along the western face of the rugged Sandia Mountains. The granite rock faces, eroded into spires, cliffs and pinnacles, the aspens, hardy pines, scrub oak, fir and spruce, are home to many different birds and other animals.



West across the Rio Grande and a volcano field, Mount Taylor rises more than 100 miles away. To the north is Cabezón, a stump of an eroded volcano, and other volcanic necks and plugs. To the north and west, Redondo Peak stands tall in the Jemez Mountains, rising from a caldera known as the Valle Grande, a volcanic crater reported to be the largest in the world. To the east lies the heavily wooded backside of the Sandias and, on the far horizon, the Sangre de Cristo Mountains. Farther to the south, the Estancia Valley and the Monzano Mountains frame the view.



**How it Works:**

The Sandia Peak Tram is 2.7 miles in diagonal length and is a bi-cable double reversible aerial passenger tramway. Both tramcars are attached to the hauling cables and the weight of the downhill tramcar helps to pull the uphill tramcar to the top. When the tramcars pass at midway, they are almost 1,000 feet above the ground. Top speed of the tramway is 24 feet per second, averaging 12 mph. The main drive is a 600 horse power dc electric winch motor. In case of a power failure, the tramcars can be returned to the terminals with an auxiliary Ford industrial engine.



Each of the four 100,000 pound track cables is stronger than required to support one car, and, as an added safety precaution, each car travels over two such cables. The tramcars were designed with track cable brakes. These brakes would close automatically and hold the car firmly in place in an emergency or haul cable failure. The brakes on the main drive are electronically/hydraulically opened before the tramcars can move. If the power should fail, the brakes are applied automatically, stopping the moving cables and tramcars.

Each tramcar is capable of carrying 48 passengers or 10,000 pounds up the mountain at a maximum rate of 200 passengers per hour. On average, the tram makes 10,500 trips per year.



Passing Tram cars at the exact halfway point.

## Planning for a Visit/ What to Prepare:

When planning your visit to the Tram there are a few important things to consider:

1. The time you will need to leave your school location to arrive to the Tram 15-30 minutes before a scheduled departure.
2. What time you will need to be back to the school. A typical school field trip can take between 45 minutes to two hours (not including travel time), depending on the number of students and number of other guests riding the Tram at the same time.
3. Determine your estimated cost of the trip using the rates below. Will this trip need approval from your school, district, etc?
4. Determine how you will pay for the trip (Purchase Order, School Check, Credit Card, Cash).
5. How will lunch be offered? Sandia Peak Tramway allows sack lunches to be brought and eaten on the outside patio at the lower terminal or on the observation deck at the upper terminal. Picnics are always fun!
6. How many chaperones will you need to attend with you for a safe and effective trip?
  - a. Elementary School: 1 chaperone for every 7 students
  - b. Middle School: 1 chaperone for every 10 students
  - c. High School: 1 chaperone for every 15 students
7. What curriculum are you covering in class that will tie into the Tram? (History, Life Zones, Science)

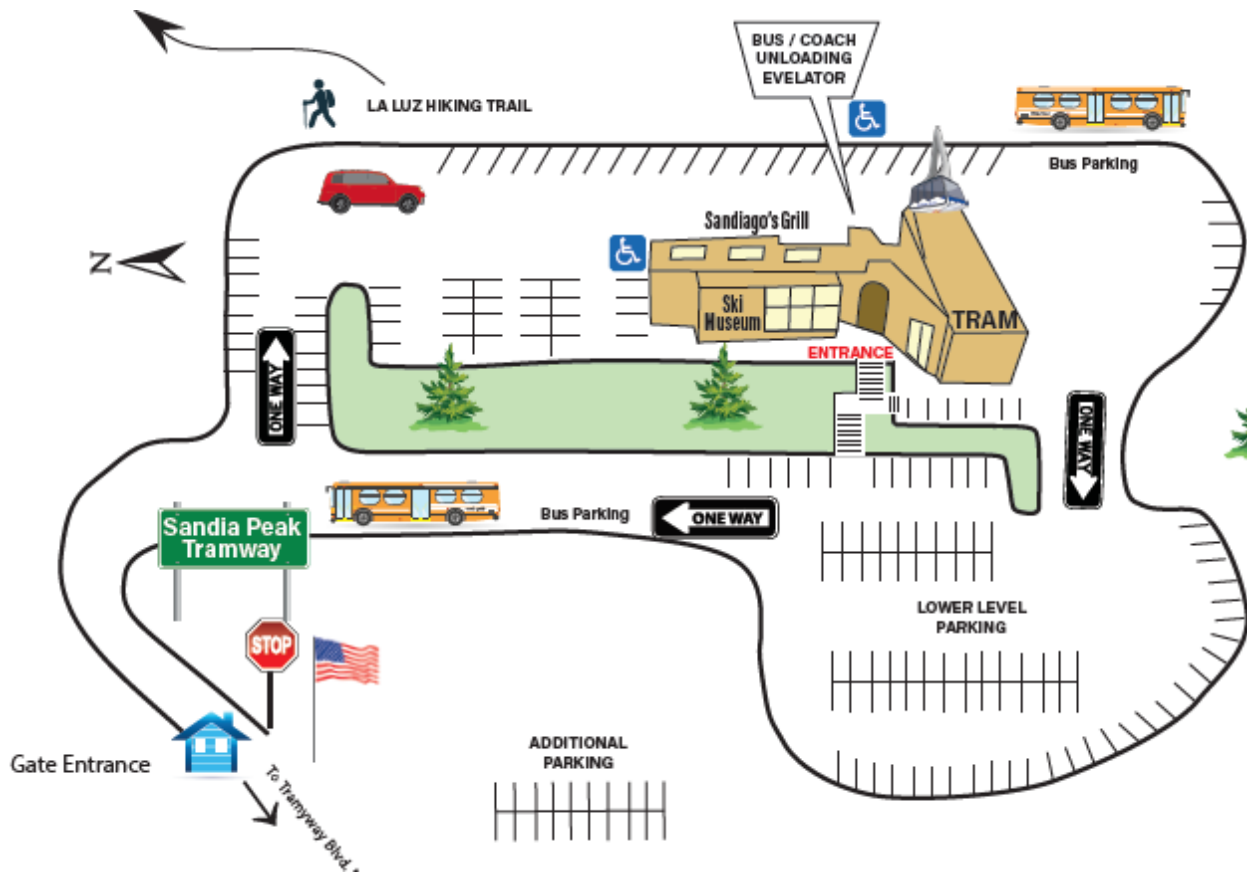
**Students: \$10.00 Adults: \$15.00**

**\*All rates include tax and are subject to change.**

## Booking Your Visit:

1. Once you are ready to book your trip, please complete the form at: [sandiapeak.com/educational/](http://sandiapeak.com/educational/).
2. Know what day and time you are planning to come and how many students and chaperones will be with you.
3. Know your method of payment (Purchase Order, Credit Card, School Check, Cash).
4. Have a name and number of the lead chaperone who can also be contacted if any changes occur.

- Accessible parking and an elevator are available on the Upper Parking level.
- Tram tickets are available on the second floor. Tram cars depart every 20 to 30 minutes. The ride is about 15 minutes each way.
- The Sandia Tram Gift Shop, located on the second floor, is open daily.





## What to Expect:

### Upon Arrival-

1. Depending on the day/time of the year, the Tram can be busy with other passengers. For safety of the students and others, be sure to keep them all in sight and near chaperones at all times. The wait between arriving at the tram and boarding the tram car can range between 15-45 minutes depending on the size of the group.
2. When you arrive, one chaperone from the group can go to the Tram ticket counter to check in, make payment and get boarding passes. It is important that this chaperone knows the method of payment and the final head count of all attending.

### Up and on the Mountain-

Your group will be climbing nearly 4,000 feet in elevation in 15 minutes

1. The Tram ride itself to the top is 15 minutes. Once at the top, you can hike, picnic, take pictures and visit the Four Seasons Visitors Center. If any students become inquisitive, any of the Tram staff are available and ready to help!
2. The weather at the top of the mountain can be anywhere between 15-30 degrees colder than in the city of Albuquerque. It is always recommended to wear closed-toed shoes and, bring or wear, long sleeves or a jacket.

\*Other important items to consider, especially if you plan to hike: water, snacks, sunscreen, hats. If they have an assignment to complete, they will need to bring a pen or pencil.

### Returning Back Down the Mountain-

1. As your group decides to head back down, the Trams are loaded as first come, first serve. They are no longer assigned by flights.
2. The Tram ride back to the bottom is 15 minutes.

Pre-Visit: Student Informative Handouts:

- 1. Tram Statistics**
- 2. Life on the Sandia Mountains**
- 3. Rio Grande Rift**
- 4. Four Ecological Life Zones**
- 5. Evergreen Chart**
- 6. Trip to Sandia Peak- Fill in the Blanks**
- 7. Scavenger Hunt**

## Tram Statistics

Sandia Peak Tramway was manufactured by Bell Engineering of Lucerne, Switzerland and constructed from 1964 to 1966 at a cost of \$2 million dollars. This system was designed to carry passengers and is referred to as a double, reversible, jig-back aerial tramway. Five thousand helicopter trips were made during construction of Tower 2, Upper Terminal and the cable installation. New Tram cars were installed on the Sandia Peak Tramway's 50th anniversary on May 7, 2016.

Track Ropes:	40 mm or 1 5/8 inches in diameter 52 tons or 47,174 kg. each
Haul Rope:	32 mm or 1 1/4 inches in diameter
Main Power Unit:	600 HP DC electric motor
Auxiliary Drive:	429 cubic inch Ford industrial engine
Total Horizontal Length:	2.7 miles or 4.5 km
Total Vertical Rise:	3,819 feet or 1,164 meters
Elevation of Lower Terminal:	6,559 feet or 1,999 meters
Elevation of Tower One:	7,010 feet or 2,137 meters
Height of Tower One:	232 feet or 70.7 meters
Elevation of Tower Two:	8,750 feet or 2,667 meters
Height of Tower Two:	80 feet or 24.4 meters
Elevation of Upper Terminal:	10,378 feet or 3,163 meters
Capacity of each Tram car (two cars):	10,000 lbs. or 4,536 kg. (48 Pass.)
Average Number of Passengers per year:	250,000
Water Tank capacity:	800 gal. or 3028 liters.
Cable span from Tower Two and the Top:	1 1/2 miles or 7,720 feet or 2,414 meters.

## Sandia Peak Tram and Cibola National Forest

### Plants:

The Sandias are graced with an abundance of plant life with over 890 species. Variations of temperature, precipitation, slope, soils, elevation, fire and the impact of humans have combined to form many plant environments that vary with the elevation. Plants include trees, shrubs, cactus, grasses, ferns, mosses and many wild flowers.

### Animals:

The Sandias provide a home for mule deer, mountain lions, foxes, raccoons, squirrels, chipmunks, black bears, rabbits, skunks and many other animals. There are about 2500 mule deer on the mountain and they are the most frequently seen animal.



### Birds:

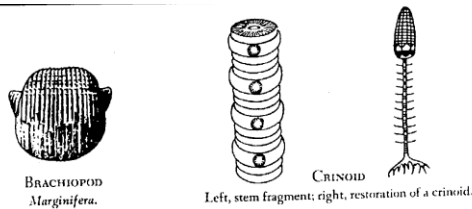
The Sandias host over 200 species of bird including golden eagles, numerous hawks, turkey vultures, falcons, ravens, woodpeckers, jays, flickers, wrens and many kinds of songbirds. Spring and Fall are prime bird-viewing times as birds use the thermals generated by the steep mountain cliffs to migrate along the mountain ridge.

### Reptiles and Amphibians:

The Sandias are home to 33 species of reptiles, six species of amphibians, 14 species of lizards and 18 species of snakes. Some of the more common ones are bull snakes, rattlesnakes, garter snakes, horned toads and blue-tailed lizards.

### Fossils:

Fossils are abundant in the limestone rocks that cover the top of the mountain. Fossils tell a story about the geologic history of the Sandia Mountains. In limestone rocks 300 million years old, fossils of horn corals, crinoids and brachiopods tell of a time when the area was covered by a shallow sea. These rocks formed at the bottom of the ocean. The hard parts of these ancient animals settled to the bottom of the sea to become part of the limey muds covering the ocean floor. Eventually the sea disappeared. About five million years ago, the Sandia Mountains began to rise. Today, these ancient sea beds are exposed again on top of the mountain.



## Sandia Peak Tram and Cibola National Forest

### Sandia Mountain and the Rio Grande Rift:

The Sandia Mountains are a large block of Earth's crust that has been uplifted and tilted on edge. The eastern side of the mountain block slopes gently to the plains. The western side drops off abruptly to the Rio Grande Rift. The highest point along the crest of the Sandia stands 10,678 feet above sea level and a mile above Albuquerque.

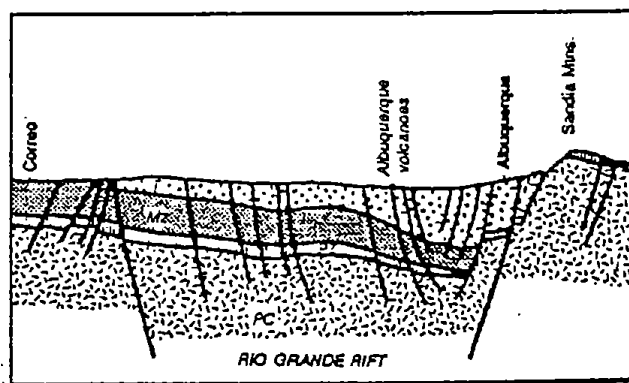
The Sandia Mountains are composed of ancient granite, 1.4 billion years old. A thin veneer of limestone only 300 million years old, caps the granite and forms the gentle eastern slope. The limestone contains abundant fossils that indicate that it was deposited in a shallow sea.

The Rio Grande Rift is a great fracture in the earth's surface which extends from Leadville, Colorado to Las Cruces. The rift was formed when a large block of the Earth's crust subsided forming a low spot bounded by mountains on either side. This provides a trough for rivers to flow, such as the Rio Grande.

Albuquerque lies in the central part of the Rio Grande Rift. The same marine limestones that cap the Sandias are 15,000 feet below sea level in the Albuquerque area. That translates to almost 5 miles of movement, making the Rio Grande Rift one of the greatest troughs on Earth. Erosion of the Sandias has slowly filled the rift valley with thousands of feet of porous sediment and with time, this sediment has soaked up rain and river water to become a huge underground reservoir.

### The Mountain:

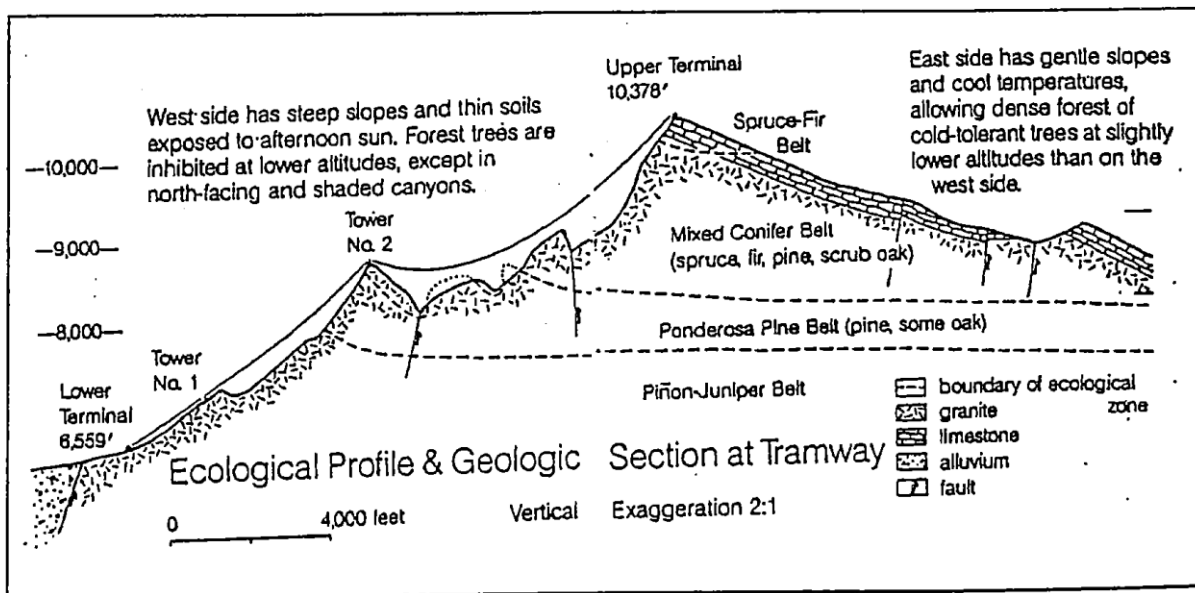
The Sandia granite was formed from magma deep beneath the Earth's crust, it slowly cooled and solidified 1.4 billion years ago. It is composed of mica, feldspar, and quartz. These combine to make the mountains appear pink at sunset. About 300 million years ago, most of New Mexico was covered by shallow-ocean. Limey deposits settled and hardened over time to become the well-layered, fossil-bearing limestone that caps the Sandias.



## Sandia Peak Tram and Cibola National Forest

While riding the tram, you will pass through four Ecological Life Zones:

1. **Upper Sonoran Zone-** The base of the tram is in the desert foothills. You will see chamisa, pinon-juniper, apache plum. The elevation is 6,500 feet above sea level.
2. **Transition Zone-** This begins at Tower One. Where you will begin to see a lot of ponderosa pine and the elevation is 7,010 feet above sea level.
3. **Canadian Zone-** This begins at Tower Two. You will begin to see aspen, scrub oak, and mixed conifer. The elevation here is 8,750 feet above sea level.
4. **Hudsonian Zone-** This is at the top of the Sandia Peak Mountains. Here you will see douglas fir, aspen, limber pine, Engelmann Spruce. The elevation here is 10,378 feet above sea level.



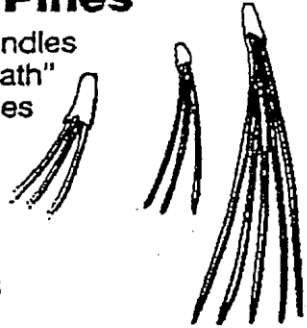
# Identification Chart for Evergreens

## Pines

needles in bundles with thin "sheath" holding needles together



cone scales thick



cones woody



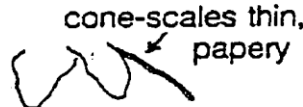
PINUS  
KEY A

## Spruces

needles single sharp stiff square



twigs rough after needles fall off



cone-scales thin, papery

cones always hang down

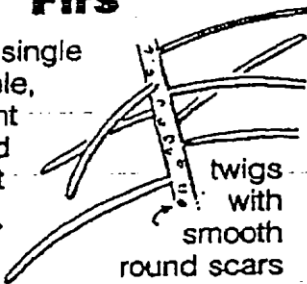


PICEA  
KEY B



## Firs

needles single flexible, blunt and flat



twigs with smooth round scars after needles fall off

central axis of cone stays after scales drop off



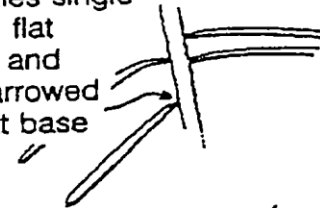
ABIES  
KEY C



cones always erect

## Douglas-fir

needles single flat and narrowed at base



identifying feature: the 3-pointed bract on cone

















PSEUDOTSUGA  
KEY C

## Sandia Peak Tram: Worksheet

1. What is the temperature at the lower terminal of the Tramway at 6,559 feet? \_\_\_\_\_
2. What is the temperature at the upper terminal at 10,378 feet? \_\_\_\_\_
3. When was the Tram completed? \_\_\_\_\_. How much did it cost to build? \_\_\_\_\_
4. Does the atmospheric pressure increase or decrease as you ascend the mountain?  
\_\_\_\_\_
5. How many life zones do you experience when riding the Tram? \_\_\_\_\_
6. Which of the four life zones is most similar to the life zone of your backyard? \_\_\_\_\_
7. Would you expect to find spruce trees above the Timber line? \_\_\_\_\_
8. Rio Grande Rift stretches from \_\_\_\_\_ to \_\_\_\_\_.
9. Name three animals living in the Biome of the Sandia Peak Mountains.  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
10. Name three plants living in the Sandia Peak Biome.  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
11. Why are marine fossils common on the Sandia Peak Mountains? \_\_\_\_\_
12. How old are the fossils in the limestone rocks? \_\_\_\_\_
13. The Sandia Mountains turn \_\_\_\_\_ at sunset.
14. What does Sandia mean in Spanish? \_\_\_\_\_
15. The lower terminal of the tram is at 6,559 feet, the upper terminal of the tram is at 10,378 feet. What is the vertical climb? \_\_\_\_\_
16. Coronado and Winrock malls are said to be exactly one mile high above sea level. About how many feet is that? \_\_\_\_\_
17. What is the direction of the flow of the Rio Grande River? \_\_\_\_\_
18. At what elevation did you first see aspen trees? \_\_\_\_\_
19. How many square miles of panoramic views from the top of the mountain? \_\_\_\_\_
20. What was your favorite part about coming to the Sandia Peak Tramway?  
\_\_\_\_\_



### Nature Scavenger Hunt

<input type="checkbox"/>  Colored Leaves	<input type="checkbox"/>  Pine Trees
<input type="checkbox"/>  Rabbit	<input type="checkbox"/>  Wild Flowers
<input type="checkbox"/>  Deer	<input type="checkbox"/>  Aspen Trees
<input type="checkbox"/>  Mountain Lion	<input type="checkbox"/>  Snake
<input type="checkbox"/>  Bear	<input type="checkbox"/>  Pine Cones
<input type="checkbox"/>  Green Moss	<input type="checkbox"/>  Cactus
<input type="checkbox"/>  Ocean Fossils	<input type="checkbox"/>  Owl

How many boxes did you check? \_\_\_\_\_

What did you not find? \_\_\_\_\_



## Answer Sheet

1. What is the temperature at the lower terminal of the Tramway at 6,559 feet? Dependent on day
  2. What is the temperature at the upper terminal at 10,378 feet? Dependent on day
  3. When was the Tram completed? May 1966. How much did it cost to build? 2 Million Dollars
  4. Does the atmospheric pressure increase or decrease as you ascend the mountain? Decreases
  5. How many life zones do you experience when riding the Tram? Four life zones.
  6. Which of the four life zones is most similar to the life zone of your backyard? Dependent in person
  7. Would you expect to find spruce trees above the Timber line? Yes.
  8. Rio Grande Rift stretches from Leadville to Las Cruces.
  9. Name three animals living in the Biome of the Sandia Peak Mountains.  
Mule deer, mountain lions, foxes, raccoons, squirrels, chipmunks, black bears, rabbits, skunks.
  10. Name three plants living in the Sandia Peak Biome.  
Trees, shrubs, cactus, grasses, ferns, mosses and many wild flowers.
  11. Why are marine fossils common on the Sandia Peak Mountains? The Sandia Mountains were once the ocean bed.
  12. How old are the fossils in the limestone rocks? 300 Million Years Old
  13. The Sandia Mountains turn Pink at sunset.
  14. What does Sandia mean in Spanish? Watermelon.
  15. The lower terminal of the tram is at 6,559 feet, the upper terminal of the tram is at 10,378 feet. What is the vertical climb? 3,819 feet
  16. Coronado and Winrock malls are said to be exactly one mile high above sea level. About how many feet is that? Average of 6,000 feet; 5,280 feet exactly.
  17. What is the direction of the flow of the Rio Grande River? North to South.
  18. At what elevation did you first see aspen trees? 8,750 feet
  19. How many square miles of panoramic views from the top of the mountain? 11,000 miles
  20. What was your favorite part about coming to the Sandia Peak Tramway?
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