

# EPIC ENGINEERING

Europe's longest bridge,  
Ponte Vasco da Gama,  
in Lisbon, Portugal

## Warm Up

**Discuss these questions with a partner.**

1. What are some modern feats of engineering?
2. What do you think is the most impressive ancient engineering feat?
3. What are some engineering feats in your country? Have you seen them? How would you describe them?



## Before You Read

**A. Scanning.** Look at the pictures and maps, and read the captions on pages 123–126. Discuss the questions with a partner.

1. Where is the Grand Canal, and when was it built?
2. What are some of the ways a canal like this might be used?
3. What were its northernmost and southernmost cities?
4. How long is the Grand Canal today? What is its northernmost city now?

**B. Predict.** For what reasons do you think the Grand Canal has been important for China? Share your ideas with a partner. Then read the passage to check your ideas.

▲ The Grand Canal, shown here passing through the city of Jining, is a large waterway that first connected north and south China over 1,400 years ago. It is still in use today.





# CHINA'S GRAND CANAL

1 For centuries, the power of Chinese emperors rose and fell with their control of the Grand Canal. Today, this important waterway is shorter than it once was, but it is still the longest man-made river in the world, and continues to play an important cultural and **economic** role in modern China.

## 5 | Construction Begins

The **original** canal system began around the year 605, when Emperor Yang realized that—in order to feed his army—he needed a way to move food quickly from China’s southern

10 rice-growing region to the country’s north. An estimated one million people, mostly farmers, worked to build the first section of the Grand Canal, which connected existing canals, lakes, and rivers. Construction took six years and was  
15 completed in 611.

Over the next 500 years, the canal's importance grew throughout China, but by 1127, parts were deteriorating.<sup>1</sup> In 1279, Kublai Khan began to **repair** and build new parts of the canal. This **renovation** created a more direct north–south route to and from Beijing. Future rulers then continued to expand and improve the canal.

## A Nation's Lifeline

In addition to moving rice around China, the Grand Canal was also an important cultural conduit.<sup>2</sup> Soldiers, merchants, and artists **transported** ideas, **regional** foods, and

cultural practices from one part of China to another along the country's watery highway. According to legend, this is how Beijing **acquired** two of its best-known trademarks: Peking<sup>3</sup> duck, a dish from Shandong Province in the south, and Peking opera, from Anhui and Hubei, also in the south.

<sup>1</sup> If something **deteriorates**, it gets worse in some way.

<sup>2</sup> A **conduit** is something that connects two or more people, places, or things.

<sup>3</sup> **Peking** is the former name for Beijing.

✓ Chinese opera performers prepare for a festival in Macao, China



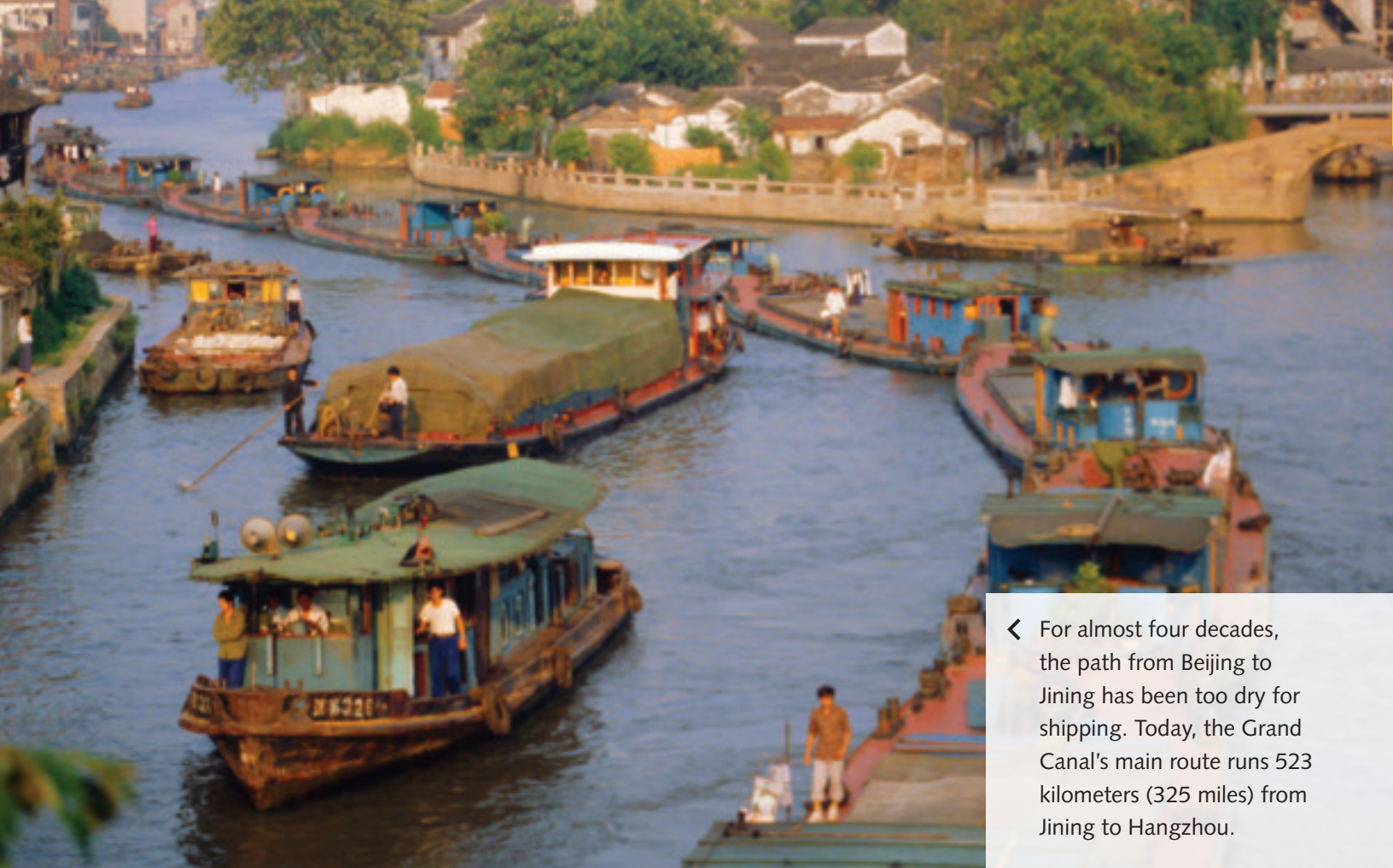


**China's Grand Canal** was built over 1,400 years ago to connect the agricultural lands in the south with the political capitals in the north. For centuries, the canal ran 1,770 kilometers (1,100 miles) between Beijing and the southern city of Hangzhou, transporting everything from food to wood and textiles.



China's last dynasty, the Qing, took control in 1644. Emperor Qinglong (above) made six inspection tours of the Grand Canal, visiting different ports and cultural sites, like the Buddhist temple on Tiger Hill in Suzhou.





◀ For almost four decades, the path from Beijing to Jining has been too dry for shipping. Today, the Grand Canal's main route runs 523 kilometers (325 miles) from Jining to Hangzhou.

## The Modern Canal

For more than a thousand years, goods have been transported along the Grand Canal. Even today, the country's watery highway plays an important economic role in China. Boats continue to carry tons of coal, food, and other goods to points between Hangzhou and Jining. In addition, local governments—eager to increase tourism and real estate<sup>4</sup> development—are working to beautify areas along the canal.

This development comes at a price, though. In Yangzhou, the city has torn down almost all of the older canal-side buildings. Farther south in the cities of Zhenjiang, Wuxi, and Hangzhou, the situation is similar. In Hangzhou, for example, almost all of the ancient buildings have been **demolished**. “Traditionally we talk about 18 main cities on the Grand Canal, and each had something unique and special about it,” explains

55 Zhou Xinhua, the **former** vice director of the Grand Canal museum in Hangzhou. “But now many of these cities are all the same: a thousand people with one face.”

60 In 2005, a group of **citizens** proposed that the historic Grand Canal be made a UNESCO World Heritage site,<sup>5</sup> to protect both the waterway and the architecture around it. “Every generation wants the next generation to understand it, to look at its monuments,” said Zhu Bingren, an artist who cowrote this proposal. The hope is that the Grand Canal, a site of cultural and economic importance—and one of the world's great engineering accomplishments—will continue to link north and south China for centuries to come.

<sup>4</sup> **Real estate** is property in the form of land and buildings.

<sup>5</sup> A **UNESCO World Heritage site** is a place that's listed by UNESCO (United Nations Educational, Scientific and Cultural Organization) as having special cultural or physical significance.

# Reading Comprehension

**Multiple Choice.** Choose the best answer for each question.

Detail

1. Why was the Grand Canal originally built?
- to allow the army to move quickly from the north to the south
  - to transport food from the southern regions of China to the northern regions
  - to enable more people to visit remote parts of China
  - to promote the cultural and traditional diversity of the south of China

Detail

2. What is NOT true about the Grand Canal?
- It originally took six years to complete its construction.
  - Even today, it is the largest man-made river in the world.
  - Around a million people worked on the first section of the canal.
  - It allowed Peking duck and Peking opera to spread to southern China.

Main Idea

3. What would be the best alternative heading for the fourth paragraph (starting line 24)?
- Renewed Importance
  - Cultural Connections
  - The Army's Highway
  - The Origins of Peking Opera

Vocabulary

4. In line 29, the word *practices* could be replaced with \_\_\_\_\_.
- traditions
  - repetitions
  - instructions
  - improvements

Paraphrase

5. Which of the following is closest in meaning to *This development comes at a price, though.* (line 46)?
- But developing the canal involves spending a lot of money.
  - But even after spending money, people might not like the development.
  - But developing it is a lot more expensive than one can imagine.
  - But there are some negative consequences to having this development.

Inference

6. The artist Zhu Bingren would probably most like to see that \_\_\_\_\_.
- the canal and the area around it are declared a heritage site
  - the canal is further expanded in an east–west direction
  - more changes are made to modernize the canal
  - a monument is created to honor China's economic and cultural importance

Cohesion

7. The following sentence would best be placed at the end of which paragraph? *The city of Yangzhou, for example, has created a beautiful park near its waterfront.*
- 1 (starting line 1)
  - 4 (starting line 25)
  - 5 (starting line 37)
  - 7 (starting line 59)

## Critical Thinking

### Interpreting:

What does Zhou Xinhua mean when he says, “. . . many of these cities are all the same: a thousand people with one face.”

### Discussion:

What do you think the Grand Canal will be like in the future? Why?

## Understanding Compound Words

Compound words are made when two (or more) words are put together to create a new word. To understand the meaning of a compound word, break it into its parts and look at the meaning of the individual words. Compound words can be a single word (e.g., *waterway*), two words (e.g., *real estate*), or two words linked by a hyphen (e.g., *man-made*).

**A. Definitions.** Scan the heading and paragraph (starting line 25) on page 124. Find and underline the compound words. Then write them next to their definitions.

1. \_\_\_\_\_ : most widely recognized
2. \_\_\_\_\_ : a road that connects two towns or cities
3. \_\_\_\_\_ : something a person or place is known for
4. \_\_\_\_\_ : something that provides help or support needed for survival

**B. Completion.** Join words from the two boxes, and write the compound words in the correct sentences. Use a dictionary to help you.

day	man
high	well
life	with

known	out
light	time
made	trip

In addition to the Grand Canal, China is **1.** \_\_\_\_\_ for another **2.** \_\_\_\_\_ wonder—the Great Wall. China's first emperor wanted a wall for protection. **3.** \_\_\_\_\_ a wall, his country was vulnerable to attack from the north. Construction began during the first emperor's **4.** \_\_\_\_\_, but work continued for many hundreds of years after his death. Each emperor added to the wall to protect his power. Construction continued until the wall was thousands of kilometers long. Today, the Great Wall still stands. It can be easily visited on a **5.** \_\_\_\_\_ from Beijing and is a **6.** \_\_\_\_\_ for many locals and international visitors.



^ A section of the Great Wall at the Hebei-Beijing border, China







## Before You Read

**A. Discussion.** Read the caption and answer the questions with a partner.

1. Many Peruvians are happy about the construction of the Transoceanic Highway. Why do you think this is?

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2. What concerns might environmentalists have about the highway?


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**B. Scan.** Scan the reading on pages 131–133, and underline any answers to the two questions above. Then read the passage closely to check your ideas.

⚡ This road is part of a new 2,600-kilometer (1,600-mile) Transoceanic Highway. The highway stretches from the Pacific Ocean in Peru and connects with Brazil's already existing highways, which travel to the Atlantic.





# PERU'S HIGHWAY OF DREAMS

1 A new road that connects the Pacific with the Atlantic could bring riches—and environmental **ruin**.

5 Mary Luz Guerra remembers a trip she took in 2003 from the city of Cusco, high in the Peruvian Andes, to her home in Puerto Maldonado, a city in the Amazon rain forest. By plane, this 320-kilometer (200-mile) journey would have taken only 37 minutes, but Mary Luz had traveled by truck: along narrow mountain roads, across rushing rivers, and through **dense** Amazon jungle. It took her  
10 three days to reach home. During the long and exhausting trip, she remembers thinking, “I can’t wait till they build that highway!” Almost ten years after that impossibly long journey, Mary Luz’s wish came true.





## 15 | Bridging a Continent

In early 2012, the Transoceanic Highway opened to public vehicles for the first time. A dream of Peru's leaders since the 1950s, work on the vast network of roads and bridges began in 2006 and was completed in late 2011. Today, the east–west passageway spans 2,600 kilometers (1,600 miles). From Peru's Pacific Ocean coastline, it continues across the Andes Mountains and through a large part of the Amazon rain forest in the Peruvian state of Madre de Dios. It then travels into Brazil, where it connects with a network of existing highways to the Atlantic.

The Transoceanic Highway has been celebrated as one of South America's greatest engineering feats, and supporters say it will greatly improve people's lives. Until recently, travel between the cities of Cusco and Puerto Maldonado in Peru

took days by bus or truck—as Mary Luz's story **illustrates**—and drivers had to use narrow, **partially** unpaved<sup>1</sup> mountain roads. Now, thanks to the new highway, the trip only takes a few hours, and is much safer.

## 40 | Improving People's Lives

In addition to making travel faster and easier, supporters say the highway will also be good for business. There is **enormous** demand in North America and Asia for Brazilian and Peruvian products, including soybeans, beef, and gold. A number of companies in Cusco and Puerto Maldonado also sell wood to different corners of the world. Many of these companies transport their lumber<sup>2</sup> to the Pacific, where it travels by ship to other countries. Thanks to the highway, wood can now reach the Pacific in days; in the

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<sup>1</sup> If a road is **unpaved**, it is mostly dirt.

<sup>2</sup> **Lumber** is wood that has been cut into boards.



◀ Sunset over the  
Amazon rain forest,  
Madre de Dios, Peru



50 past, it could take a week or more. This lowers costs and allows the wood to reach a company's **customers** sooner, and also in better condition. In the long run, say many business owners, this will mean more profit.

55 The highway will also open up areas of the Peruvian Amazon that were **inaccessible** just a few years ago. The highway may increase activity in these areas and give people new places to live and travel to. This, in turn, could  
60 mean more jobs and money for Peruvians.

## Environmental Challenges

65 Despite the highway's many potential benefits, environmentalists are concerned. The Transoceanic passes directly through a large part of the Amazon rain forest, in the state of Madre de Dios in Peru. According to a Peruvian

government study, the forested area in the western mountains of this state has the greatest biodiversity<sup>3</sup> of any place on Earth, and until  
70 recently, large parts of the forest were in pristine<sup>4</sup> condition. As more people are moving into the region, environmentalists are worrying about the **impact** this will have on the Amazon's plants and animals, many of which are found  
75 nowhere else.

Shortly after the highway opened, large numbers of people began coming into Puerto Maldonado from all over Peru—and the world—to mine gold. There's a lot of money to be made in  
80 mining, as well as in farming, says environmental photographer Gabby Salazar. "I think we're going to see a big increase in farming," she says. "Right across the border in Brazil, you see soybean farms all over the place." Studies  
85 show three-quarters of the deforestation<sup>5</sup> of the Brazilian Amazon **occurs** within 50 kilometers (30 miles) of a highway, and environmentalists like Salazar are concerned that the same thing will happen in Peru. "It's having an impact on  
90 the environment," she explains. "It's having an impact on the people as well."

Faced with these risks, many Peruvians talk about the importance of being **practical**. "In rural<sup>6</sup>  
95 Peru, a lot of people are living in poverty, so it's very difficult to say don't build the highway," explains Roger Mustalish, president of the Amazon Center for Environmental Education and Research. "But every time you see a road like this going through, you soon see major  
100 changes." Will these changes be mostly positive or negative? Many Peruvians are hopeful, but only time will tell.

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**3 Biodiversity** is the existence of a wide variety of living things (plants, animals, insects, etc.) in a certain place.

**4** If something is **pristine**, it is in its original condition or is unspoiled.

**5 Deforestation** is the destruction or cutting down of all the trees in an area.

**6 Rural** places are in the country, far away from cities.

# Reading Comprehension

**Multiple Choice.** Choose the best answer for each question.

Gist

1. What is the reading mainly about?
  - a. the impact a highway will have on the environment and people of Peru
  - b. how the Brazilian government helped the people of Peru build a new highway
  - c. a new development that is resulting in mining and farming jobs
  - d. how environmentalists are protecting the Amazon's diverse wildlife

Detail

2. What is true about the Transoceanic Highway?
  - a. Its construction began in the 1950s.
  - b. It helps connect the Pacific Ocean with Brazil.
  - c. It was opened to the public in 2006.
  - d. It begins at the Atlantic Ocean.

Vocabulary

3. The phrase *In the long run* (line 53) could be replaced by \_\_\_\_\_.
  - a. on the other hand
  - b. as expected
  - c. eventually
  - d. optimistically

Detail

4. What is NOT given as a reason the highway will be good for Peru?
  - a. The cost of transporting goods will be lower.
  - b. Goods will reach customers in better condition.
  - c. It will increase the number of tourists in Peru.
  - d. Goods will reach customers faster.

Detail

5. Which of the following concerns does the reading specifically mention?
  - a. Increased mining will lead to soil erosion.
  - b. Farming will lead to an increase in water pollution.
  - c. The highway will have an impact on plants and animals.
  - d. The cities along the highway will become overpopulated.

Reference

6. In line 92, what does *these risks* refer to?
  - a. environmental risks
  - b. financial risks
  - c. transportation risks
  - d. depopulation risks

Main Idea

7. What would be the best heading for the final paragraph?
  - a. A Positive Future
  - b. Finding the Right Balance
  - c. An End to Poverty
  - d. Say No to Highways

## Critical Thinking

**Evaluating:** Who do you think the Transoceanic Highway will benefit the most? In what way?  
\_\_\_\_\_

**Discussion:** Think of a large construction project in your country. Do you think the advantages outweighed the disadvantages?



## Organizing Notes in a T-chart

One way to organize your notes about a reading is to use a T-chart. A T-chart is particularly useful when you need to examine two aspects of a topic. For example, a T-chart can be used to note similarities and differences, compare advantages and disadvantages, show problems and solutions, evaluate pros and cons, or separate facts from opinions.

**A. Analyzing.** Look at the following types of texts. Check (✓) the three in which you would probably use a T-chart to organize your notes.

1.  a list of tips for getting into the top college in the country
2.  a comparison of pursuing a science degree vs. pursuing an arts degree
3.  an article about how a neighborhood fought back against an increase in crime
4.  a blog post about a guided food tour of a Paris market
5.  an article about problems caused by crime in a neighborhood and some possible solutions
6.  a summary of why a community is divided over the construction of a new shopping mall

**B. Completion.** Look back at the reading on pages 131–133. Complete the T-chart with words from the text.

How the highway may help	How the highway may harm
<ul style="list-style-type: none"> <li>• <i>f</i> _____, safer, and easier travel</li> <li>• <i>b</i> _____ for business</li> <li>• gives people new areas to <i>l</i> _____ in and travel to</li> <li>• more <i>j</i> _____ and more money for locals</li> </ul>	<ul style="list-style-type: none"> <li>• crosses an area high in <i>b</i> _____</li> <li>• crosses an area in pristine <i>c</i> _____</li> <li>• has <i>i</i> _____ on plants, animals, and people</li> <li>• leads to deforestation from mining and <i>f</i> _____</li> </ul>

## Vocabulary Practice

**A. Completion.** Complete the information by circling the correct word in each pair.

For the past decade, engineers have been at work deep under the Swiss Alps, building a(n) **1. (enormous / practical)** tunnel. Although only **2. (partially / densely)** completed, the Gotthard Base Tunnel will be the world's longest and deepest railway tunnel when it opens in 2017. Once that **3. (illustrates / occurs)**, high-speed trains will travel through the Alps at 250 kilometers (155 miles) per hour.

In the last few decades, a huge number of trucks crossing the Alps have had an enormous **4. (customer / impact)** on the environment. The new tunnel provides a(n) **5. (practical / inaccessible)** solution to this problem. Goods will be transported by train between northern and southern Europe, without **6. (illustrating / ruining)** the beautiful mountain landscape.

**B. Definitions.** Use the correct form of words in **A** to complete the definitions.

1. A(n) \_\_\_\_\_ jungle has many plants in it.
2. If something has been \_\_\_\_\_, it has been broken and destroyed.
3. People who buy goods and services from a business are its \_\_\_\_\_.
4. If something is \_\_\_\_\_, it is difficult or impossible to reach.
5. If something \_\_\_\_\_ another thing, it serves as an example of that thing.

A village in the >  
Swiss Alps



- ^ At 57 kilometers (35 miles) long, the Gotthard Base Tunnel will be the world's longest railway tunnel.

### Word Partnership

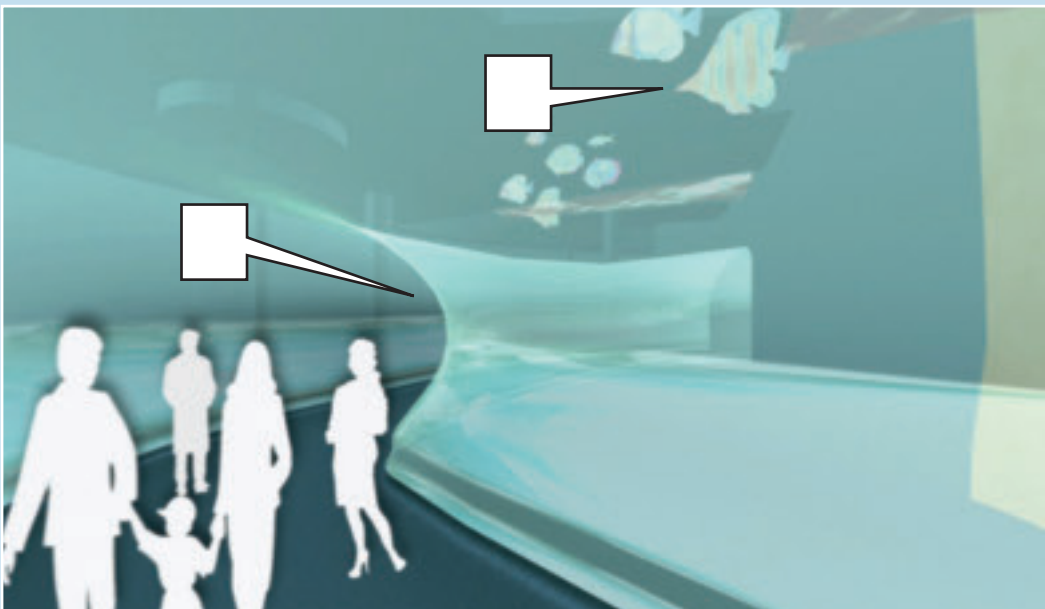
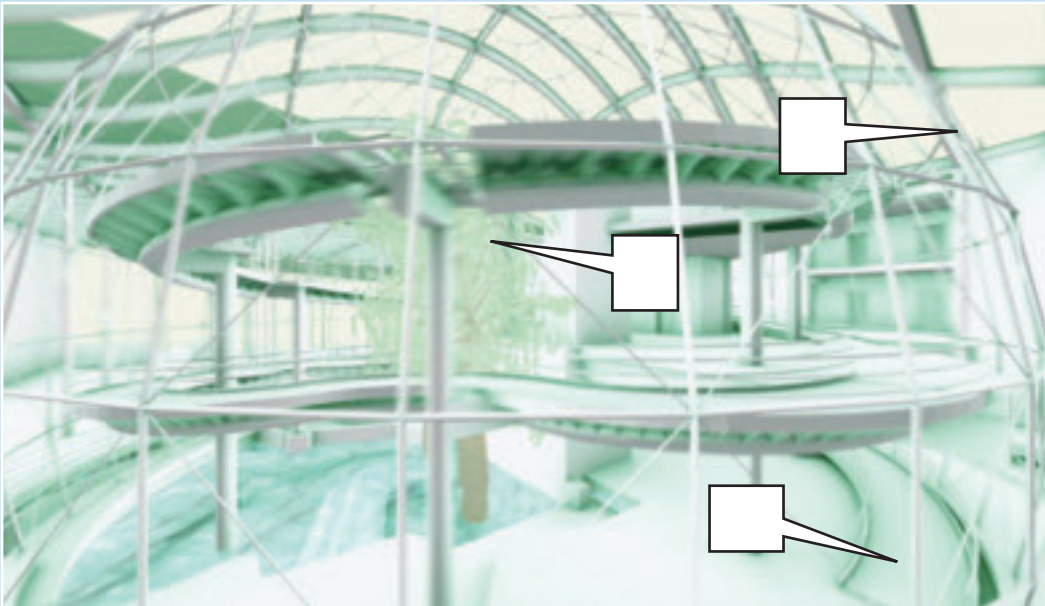
Use **dense** with:  
dense **jungle**, dense **forest**, dense **fog**,  
dense **vegetation**.



# VIEWING Birth of a Rain Forest

## Before You Watch

- A. **Labeling.** Look at the picture and read a description of a “Green Museum.” Use the words in **bold** to label the parts of the picture (1–5).



Guests will walk up a spiral **1. ramp**, inside the glass **2. dome**, all the way up through the trees to the **3. canopy**, to parts of the tree that would normally be inaccessible. Then they ride a glass elevator all the way down to a **4. tunnel** under the rain forest. Here, they can see the marine animals in the **5. aquarium**.

## While You Watch

**A. Noticing.** The rain forest exhibit and aquarium will contain many different types of animals. Circle all the animals that are mentioned.

birds                      monkeys                      stingrays                      insects                      fish  
sharks                      butterflies                      turtle                      whales                      snakes

**B. Multiple Choice.** Choose the best answer for each question.

1. What is true about the California Academy of Sciences?
  - a. It's in Los Angeles.
  - b. It gets 20 million visitors a year.
  - c. It's the largest green museum in the world.
2. What does Chris Andrews say about the rain forest exhibit?
  - a. There will be two of every animal.
  - b. It will feel and smell like a real rain forest.
  - c. It will be as good as replacing nature.
3. Who is Diego?
  - a. a turtle
  - b. the first visitor
  - c. Chris Andrews' assistant

## After You Watch

**A. Discussion.** Work in a group. Imagine you want to create a green museum. Discuss the following questions.

1. What would the place look like?
2. What plants and animals would you include?
3. Where and how would you display them?

Now, in your groups, draw a plan of your museum and label all the important features. How is the architecture of your museum similar to or different from the one you just saw?

- ✓ Innovative indoor forest exhibits can now be found in other cities, such as Singapore's Gardens by the Bay.

