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By the Numbers II

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WPS Community Foundation[®]

By The Numbers America Uses Energy

Part 2



This presentation created and updated with the best
information available
from the **United States Energy Information
Administration** July, 2020

Nonrenewable Energy Resources



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Nonrenewable Energy Resources...



...are energy resources that are limited and can eventually run out. These sources of energy cannot be replaced by natural processes on a time span of human significance.

Petroleum



Question 1

1. Resource petroleum is used to power the following sectors of the American economy. Match each sector of the economy with the percent of petroleum going to it.

70 %	_____	Commercial (a.)
24 %	_____	Electric Power (b.)
3 %	_____	Industrial (c.)
2 %	_____	Residential (d.)
1 %	_____	Transportation (e.)

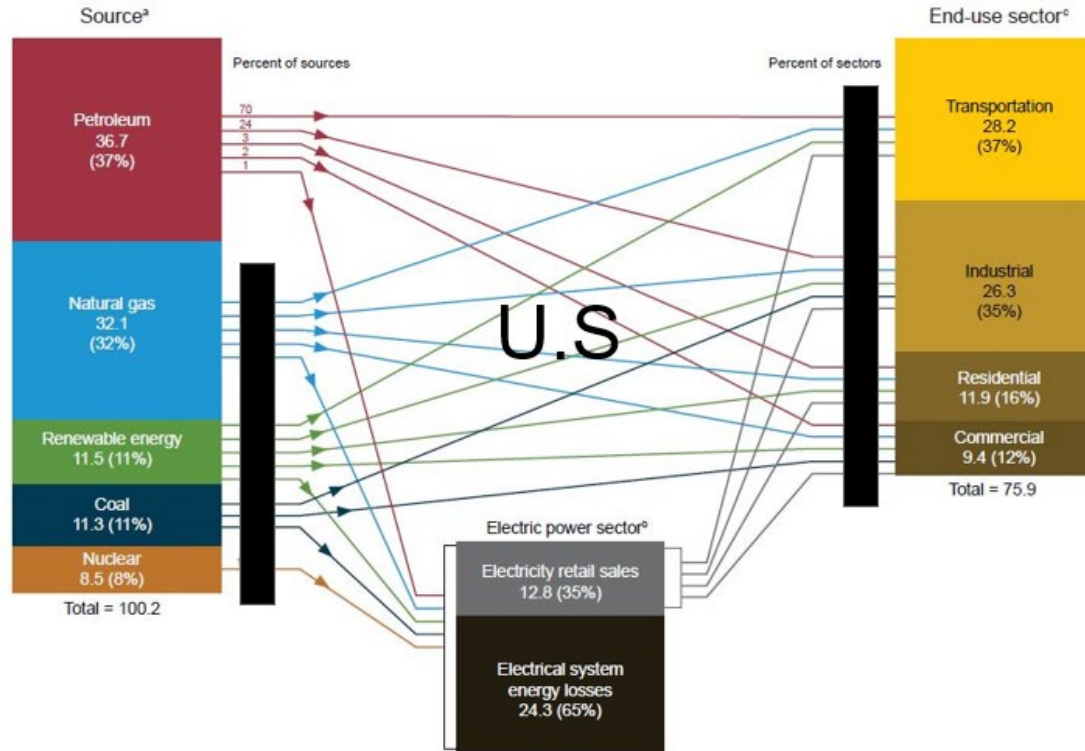
Question 1 Answer 1

1. Resource petroleum is used to power the following sectors of the American economy. Match each sector of the economy with the percent of petroleum going to it.

70 % Transportation (e.)

Petroleum Source

U.S. energy consumption by source and sector, 2019
(Quadrillion Btu)



Question 1 All Answers

1. Resource petroleum is used to power the following sectors of the American economy. Match each sector of the economy with the percent of petroleum going to it.

70 %	Transportation (e.)
24 %	Industrial (c.)
3 %	Residential (d.)
2 %	Commercial (a.)
1 %	Electric Power (b.)

Question 2

2. Rank the following “states” in order of their crude oil production.

- | | | |
|-----|-------|---------------------|
| # 1 | _____ | Gulf of Mexico (a.) |
| # 2 | _____ | New Mexico (b.) |
| # 3 | _____ | North Dakota (c.) |
| # 4 | _____ | Oklahoma (d.) |
| # 5 | _____ | Texas (e.) |

Question 2 Answer 1

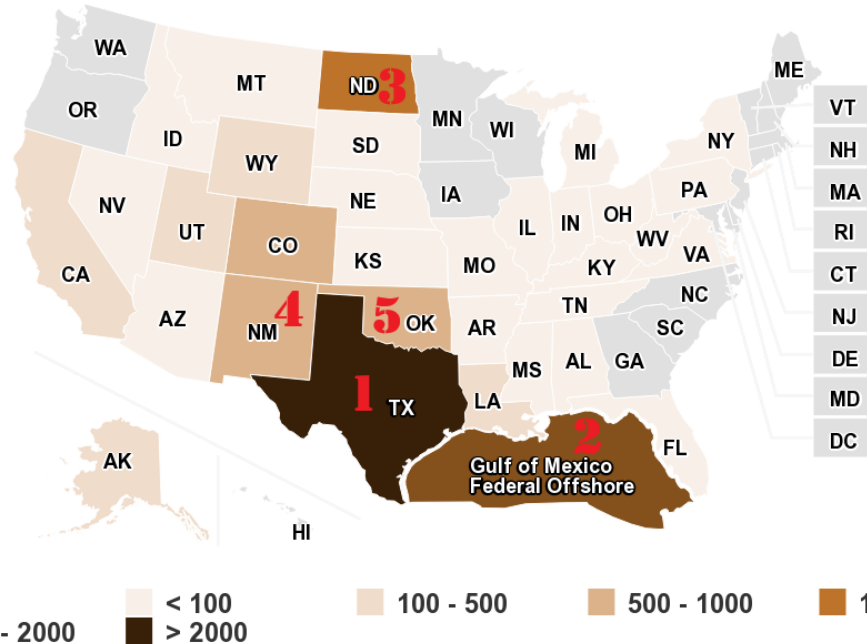
2. Rank the following “states” in order of their crude oil production.

1 Texas (e.)

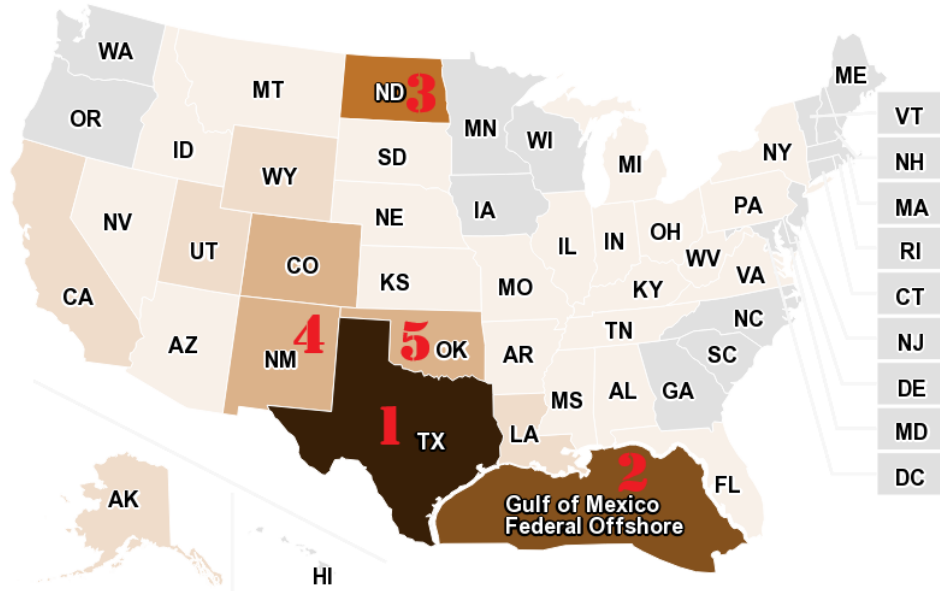
U.S. Crude Oil Production Map

U.S. crude oil production by state in 2019

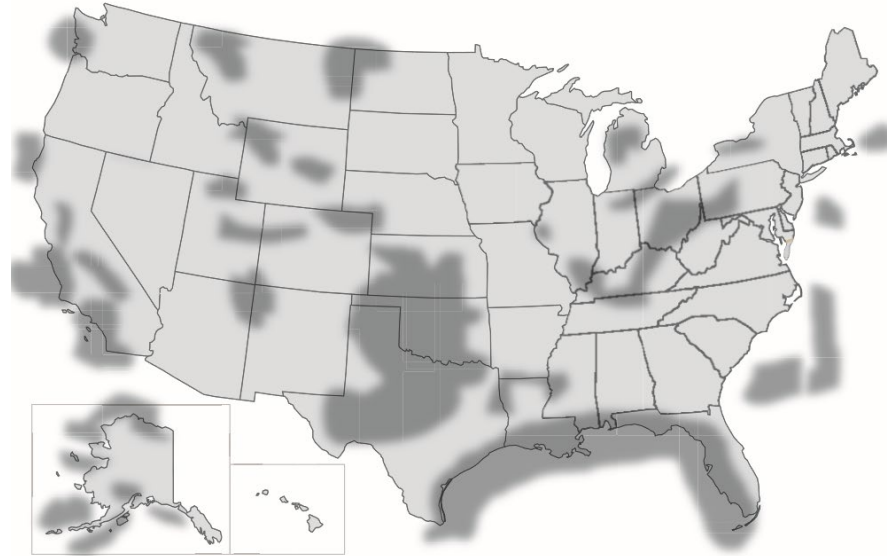
1,000 barrels per day



Oil and Gas Maps



U.S. Oil and Gas Basins



Data: Energy Information Administration

Question 2 All Answers

2. Rank the following “states” in order of their crude oil production.

- # 1 Texas (e.)
- # 2 Gulf of Mexico (a.)
- # 3 North Dakota (c.)
- # 4 New Mexico (b.)
- # 5 Oklahoma (d.)

Question 3

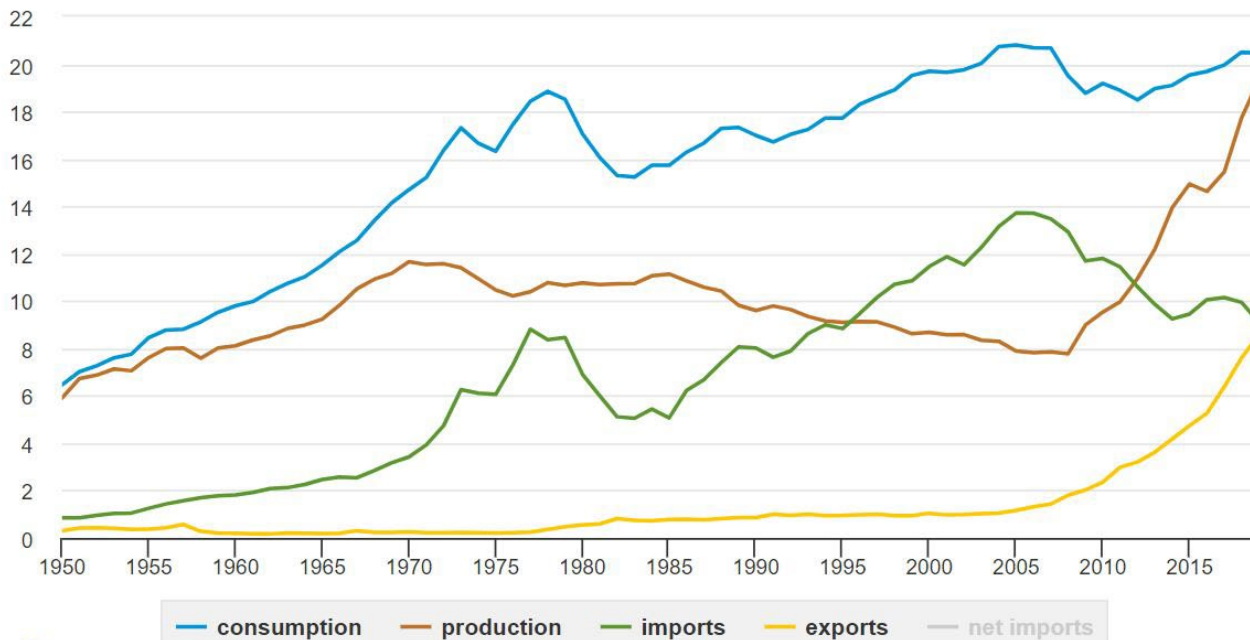
3. What is the trend in the United States with respect to petroleum production and petroleum imports over the last decade?

- a. US production is up, and American imports are up
- b. US production is up, and American imports are down
- c. US production is down, and American imports are up
- d. US production is down, and American imports are down

U.S. Petroleum Graph

U.S. petroleum consumption, production, imports, exports, and net imports, 1950-2019

million barrels per day



Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 3.1, March 2020, preliminary data for 2019

Question 3 Answer

3. What is the trend in the United States with respect to petroleum production and petroleum imports over the last decade?

Correct Answer:

b. US production is up, and American imports are down

Question 4

4. Rank the following in order of the volume of crude oil the US imports from each country.

- | | | |
|-----|-------|-------------------|
| # 1 | _____ | Canada (a.) |
| # 2 | _____ | Colombia (b.) |
| # 3 | _____ | Iraq (c.) |
| # 4 | _____ | Mexico (d.) |
| # 5 | _____ | Saudi Arabia (e.) |

Question 4 Answer 1

4. Rank the following in order of the volume of crude oil the US imports from each country.

1 Canada (a.)

Top Five Sources of U.S. Crude Oil

The top five sources of U.S. crude oil imports by share of total crude oil imports in 2019 were:

- 56% Canada
- 9% Mexico
- 7% Saudi Arabia
- 5% Iraq
- 5% Columbia



Question 4 All Answers

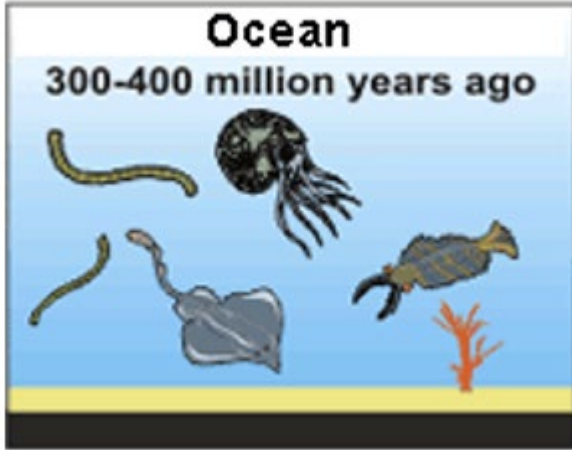
4. Rank the following in order of the volume of crude oil the US imports from each country.

- # 1 Canada (a.)
- # 2 Mexico (d.)
- # 3 Saudi Arabia (e.)
- # 4 Iraq (c.)
- # 5 Colombia (b.)

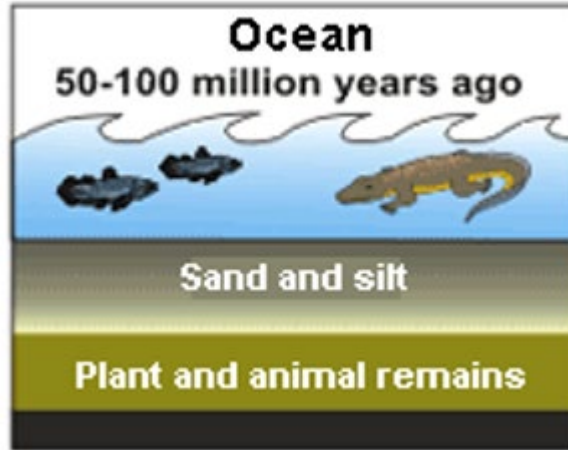
Question 5

5. Petroleum was most likely formed over hundreds of millions of years from:
- a. Fires which commonly occurred while the earth was forming
 - b. The remains of tropical and semi-tropical swamp plants
 - c. The remains of tiny sea plants and animals
 - d. Cosmic rays bombarding elements in the soil below the crust of the earth

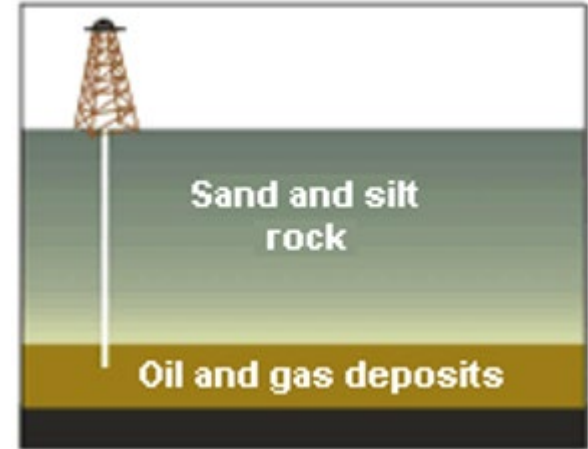
Petroleum and Natural Gas Formation (1)



Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of silt and sand.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.



Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and gas deposits.

Question 5 Answer 1

5. Petroleum was most likely formed over hundreds of millions of years from:

Correct Answer:

c. The remains of tiny sea plants and animals

Natural Gas



Question 6

6. Resource natural gas is used to power the following sectors of the American economy. Match each sector of the economy with the percent of natural gas going to it.

36 %	_____	Commercial (a.)
33 %	_____	Electric Power (b.)
16 %	_____	Industrial (c.)
11 %	_____	Residential (d.)
3 %	_____	Transportation (e.)

Question 6 Answer 1

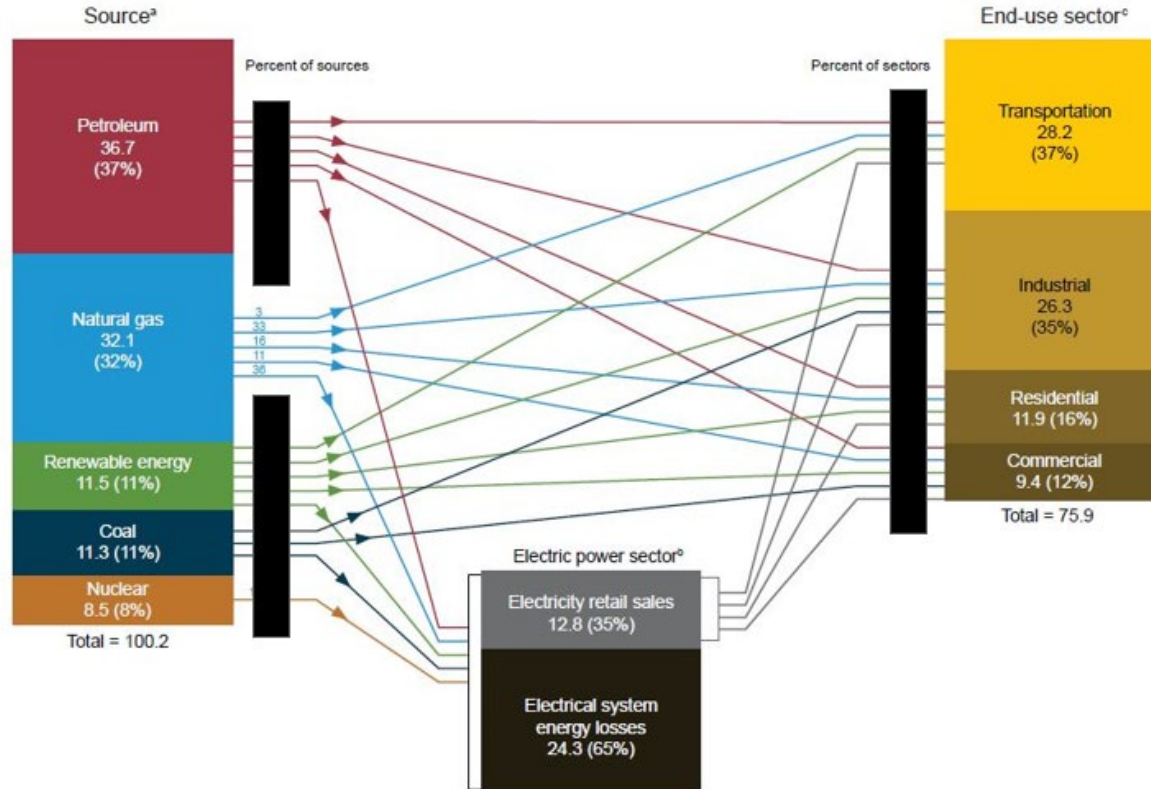
6. Resource natural gas is used to power the following sectors of the American economy. Match each sector of the economy with the percent of natural gas going to it.

36 % Electric Power (b.)

Natural Gas Source

U.S. energy consumption by source and sector, 2019

(Quadrillion Btu)



Question 6 All Answers

6. Resource natural gas is used to power the following sectors of the American economy. Match each sector of the economy with the percent of natural gas going to it.

36 %	Electric Power (b.)
33 %	Industrial (c.)
16 %	Residential (d.)
11 %	Commercial (a.)
3 %	Transportation (e.)

Question 7

7. Rank the following states in order of their natural gas production.

- | | | |
|-----|-------|-------------------|
| # 1 | _____ | Louisiana (a.) |
| # 2 | _____ | Ohio (b.) |
| # 3 | _____ | Oklahoma (c.) |
| # 4 | _____ | Pennsylvania (d.) |
| # 5 | _____ | Texas (e.) |

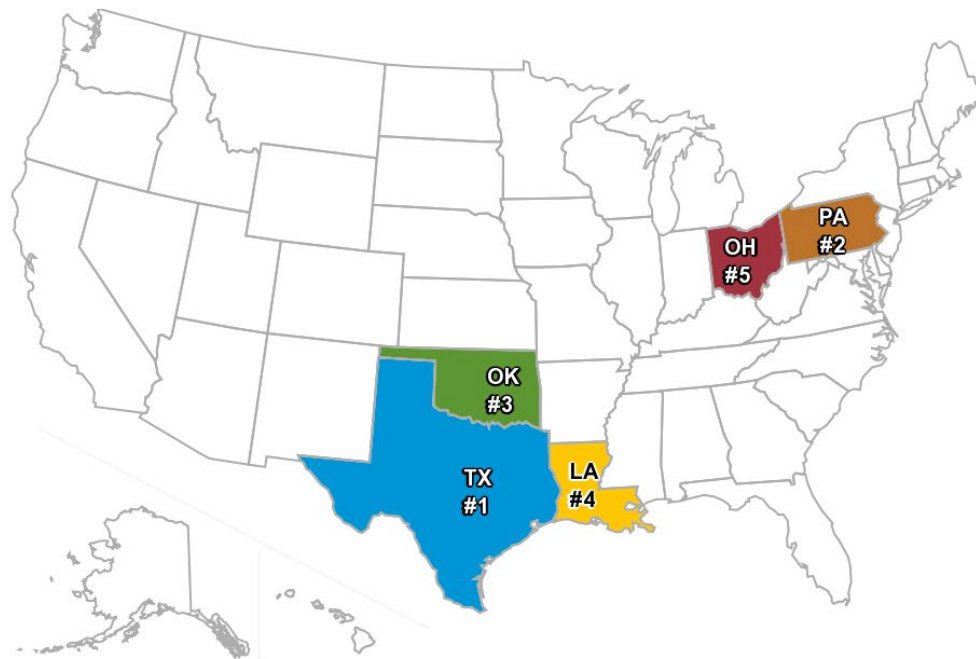
Question 7 Answer 1

7. Rank the following states in order of their natural gas production.

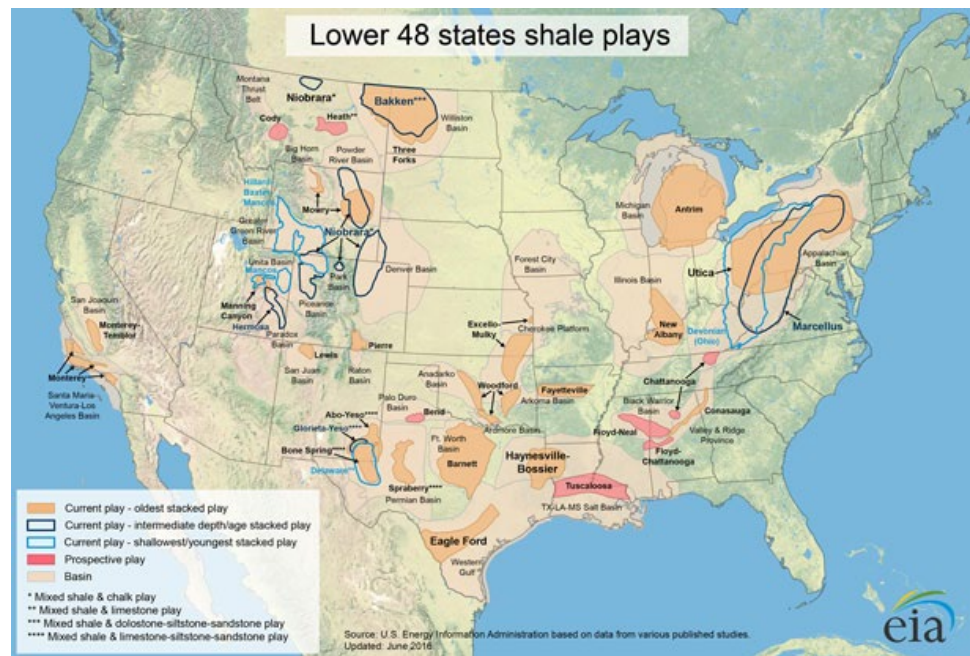
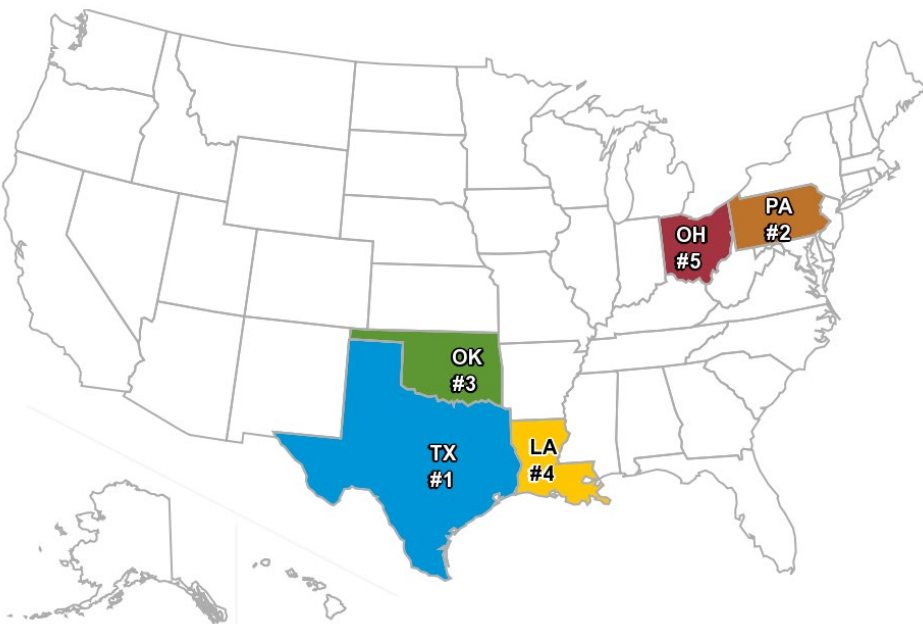
1 **Texas (e.)**

Top Five Natural Gas States

Top five dry natural gas producing states, 2018



Natural Gas and Shale Map



Question 7 All Answers

7. Rank the following states in order of their natural gas production.

- # 1 Texas (e.)
- # 2 Pennsylvania (d.)
- # 3 Oklahoma (c.)
- # 4 Louisiana (a.)
- # 5 Ohio (b.)

Question 8

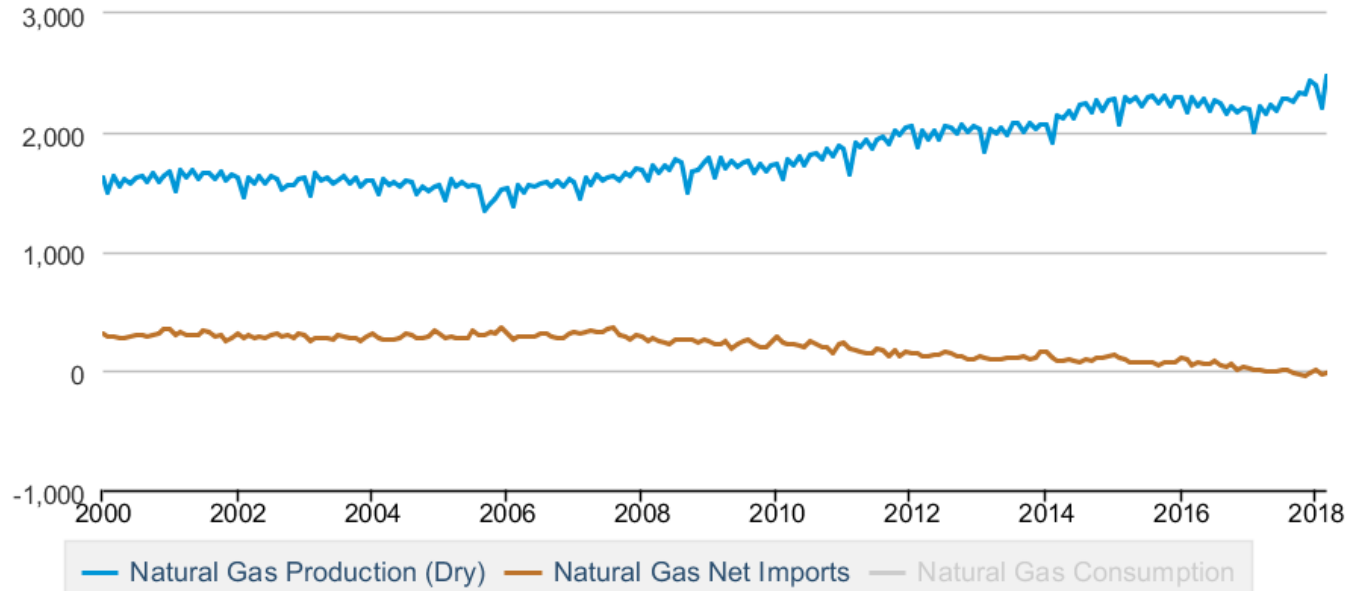
8. What is the trend in the United States with respect to natural gas production and natural gas imports over the last decade?

- a. US production is up, and American imports are up
- b. US production is up, and American imports are down
- c. US production is down, and American imports are up
- d. US production is down, and American imports are down

Natural Gas Overview

Table 4.1 Natural Gas Overview

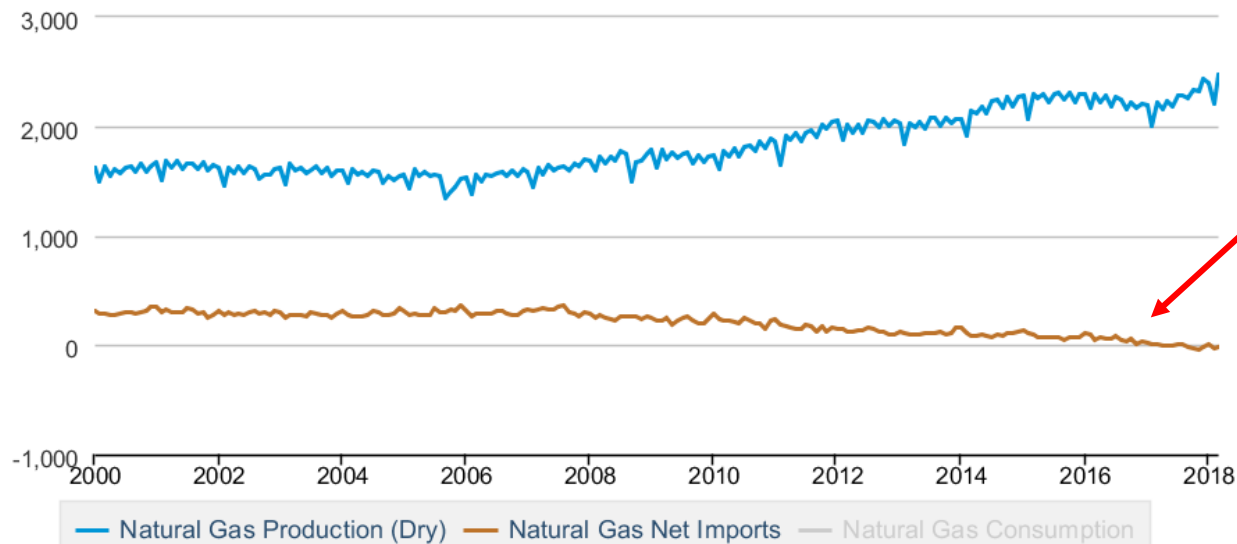
Billion Cubic Feet



Natural Gas Overview Continued

Table 4.1 Natural Gas Overview

Billion Cubic Feet



The United States was a net exporter of natural gas in 2017.

Question 8 Answer

8. What is the trend in the United States with respect to natural gas production and natural gas imports over the last decade?

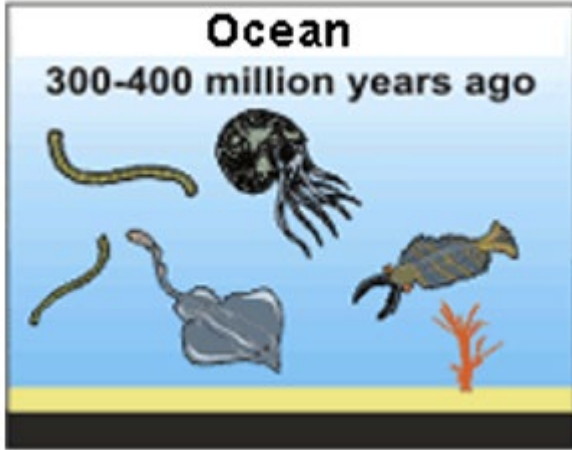
Correct Answer:

b. US production is up, and American imports are down

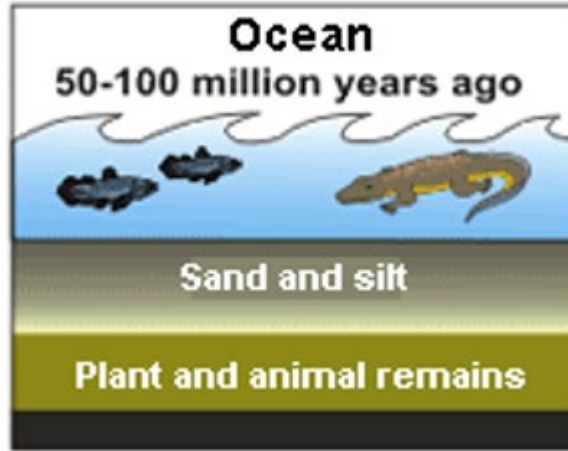
Question 9

9. Natural gas was most likely formed over hundreds of millions of years from:
- a. Fires which commonly occurred while the earth was forming
 - b. The remains of tropical and semi-tropical swamp plants
 - c. The remains of tiny sea plants and animals
 - d. Cosmic rays bombarding elements in the soil below the crust of the earth

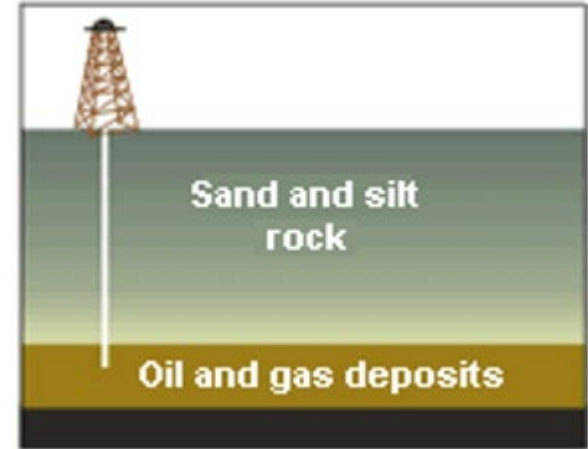
Petroleum and Natural Gas Formation (2)



Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of silt and sand.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.



Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and gas deposits.

Question 9 Answer

9. Natural gas was most likely formed over hundreds of millions of years from:

Correct Answer:

c. The remains of tiny sea plants and animals

Coal



Question 10

10. Resource coal is used to power the following sectors of the American economy. Match each sector of the economy with the percent of coal going to it.

90 %	_____	Commercial (a.)
10 %	_____	Electric Power (b.)
<1 %	_____	Industrial (c.)

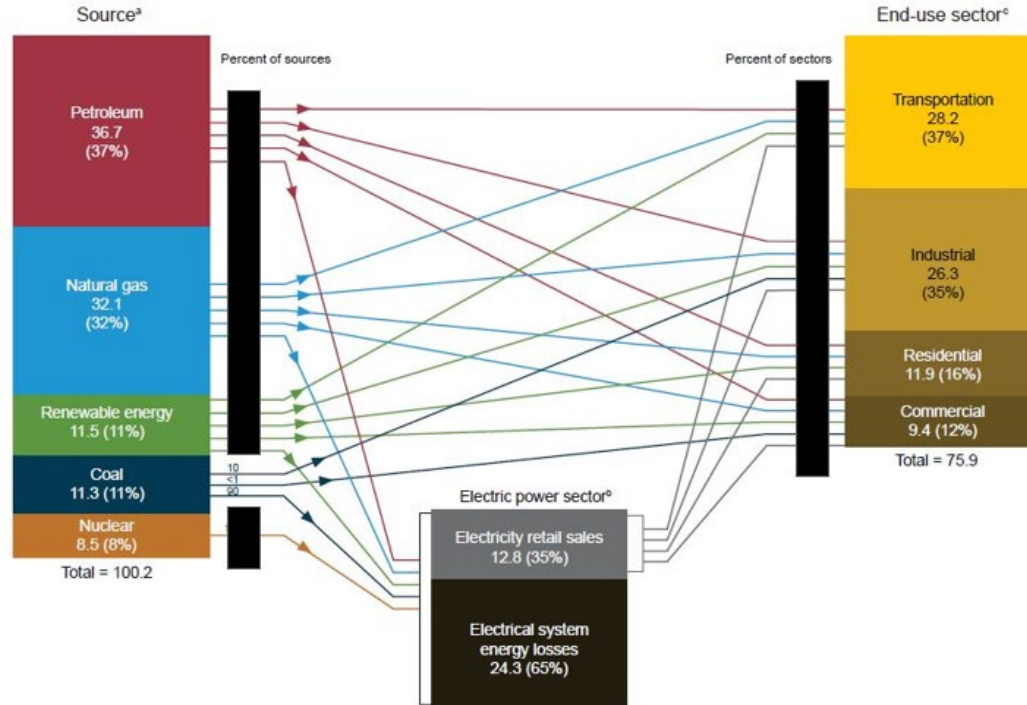
Question 10 Answer 1

10. Resource coal is used to power the following sectors of the American economy. Match each sector of the economy with the percent of coal going to it.

90 % Electric Power (b.)

Coal Source

U.S. energy consumption by source and sector, 2019
(Quadrillion Btu)



Question 10 All Answers

10. Resource coal is used to power the following sectors of the American economy. Match each sector of the economy with the percent of coal going to it.

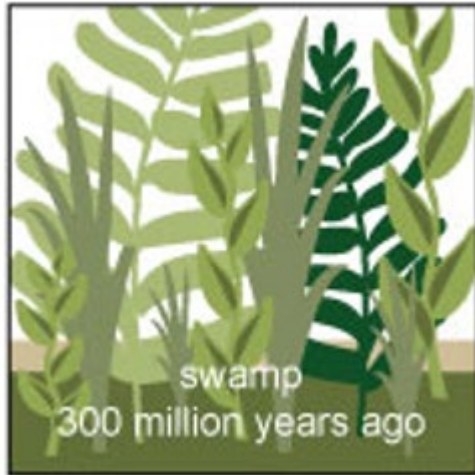
90 %	Electric Power (b.)
10 %	Industrial (c.)
<1 %	Commercial (a.)

Question 11

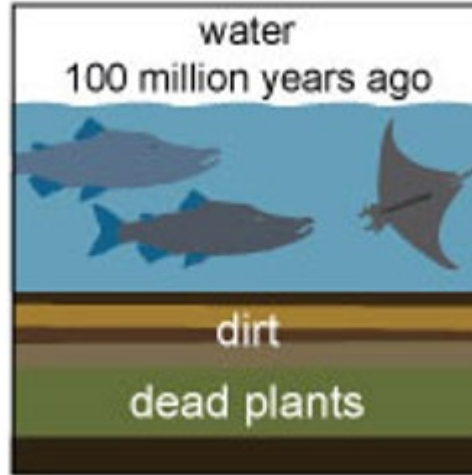
11. Coal was most likely formed over hundreds of millions of years from:
- a. Fires which commonly occurred while the earth was forming
 - b. The remains of tropical and semi-tropical swamp plants
 - c. The remains of tiny sea plants and animals
 - d. Cosmic rays bombarding elements in the soil below the crust of the earth

How Coal was formed

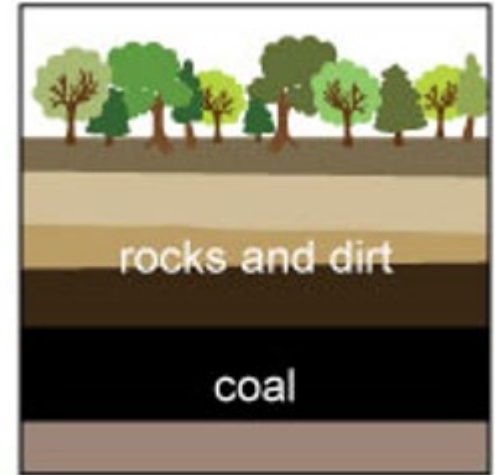
Before the dinosaurs,
many giant plants died in
swamps



Over millions of years,
the plants were buried
under water and dirt.



Heat and pressure turned
the dead plants into coal.



Source: Adapted from National Energy Education Development Project (public domain)

Question 11 Answer

11. Coal was most likely formed over hundreds of millions of years from:

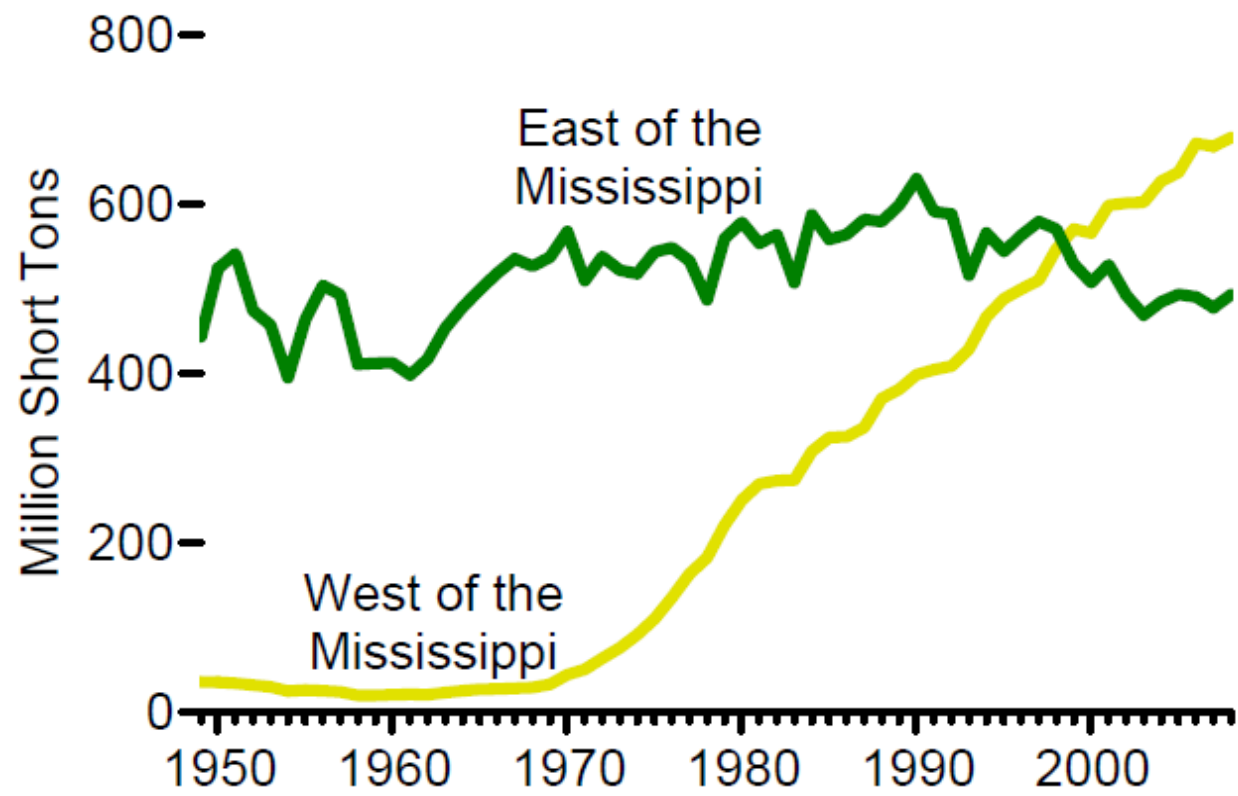
Correct Answer:

b. The remains of tropical and semi-tropical swamp plants

Question 12

12. Most of the coal used in America comes from:
- a. Suppliers east of the Mississippi River
 - b. Suppliers west of the Mississippi River

Coal Production by Location



Question 12 Answer

12. Most of the coal used in America comes from:

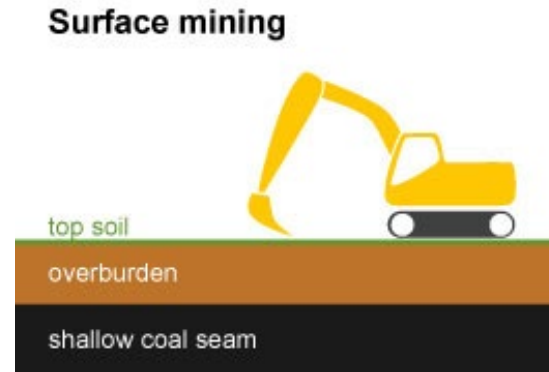
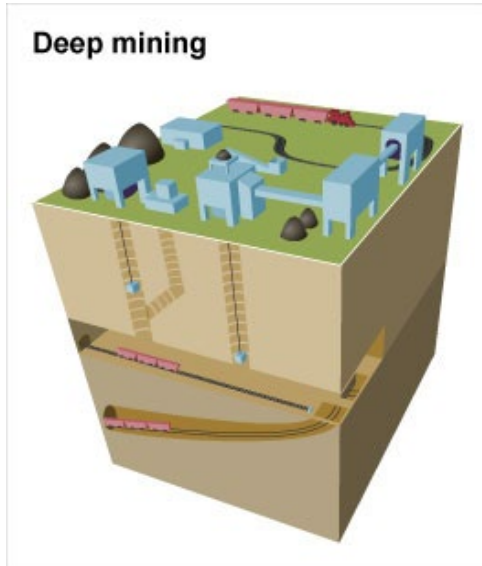
Correct Answer:

b. Suppliers west of the Mississippi River

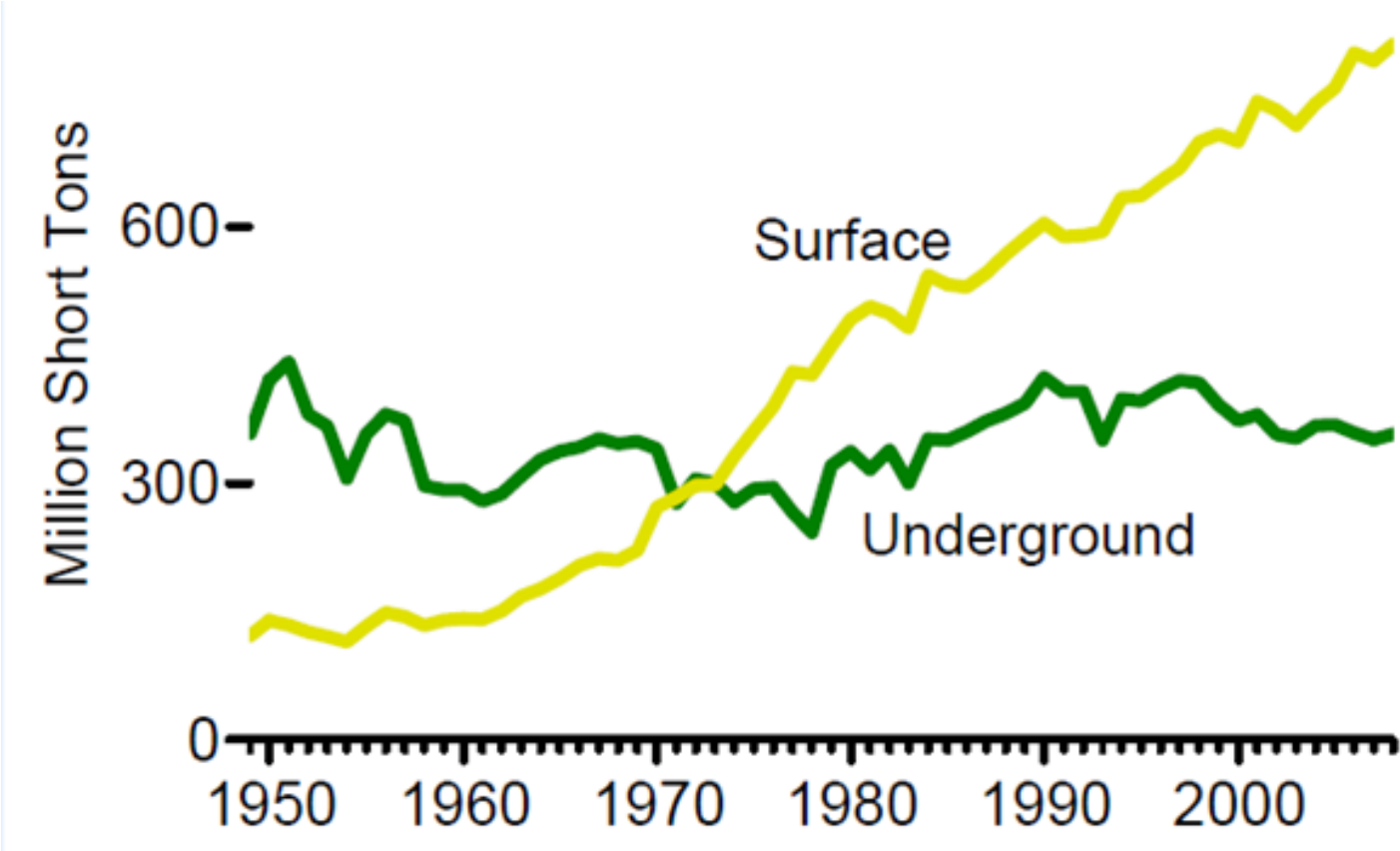
Question 13

13. Most of the coal used in America comes from:

- a. Deep shaft mining
- b. Surface mining



Coal Production By Mining Method

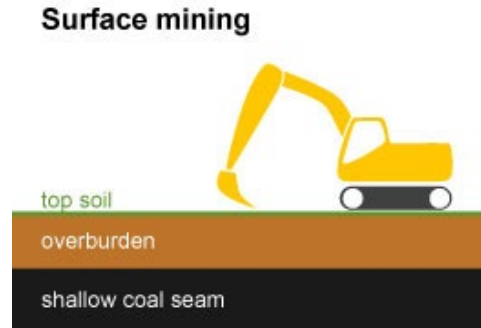
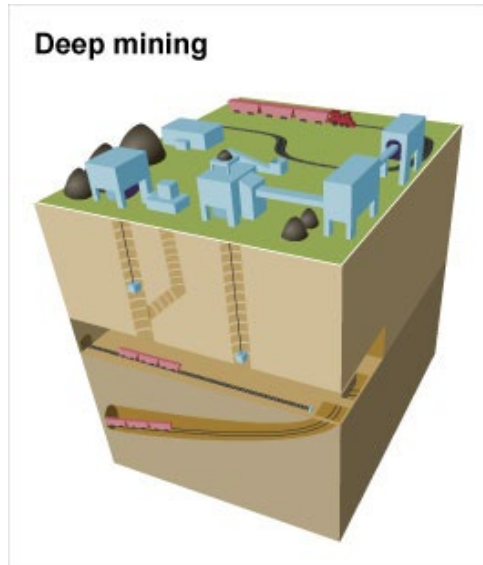


Question 13 Answer

13. Most of the coal used in America comes from:

Correct Answer:

b. Surface mining (most Western coal is removed this way)



Question 14

14. Why does most of the coal used in America come from the Western United States?

Question 14 Answer

14. Why does most of the coal used in America come from the Western United States?

Western coal is generally cheaper to mine (surface mining)

and

Western coal generally contains less sulfur (so there is less sulfur dioxide (SO_2) released when it is burned at the power plant)



Question 15

15. Rank the following states in order of their coal production.

- | | | |
|-----|-------|--------------------|
| # 1 | _____ | Illinois (a.) |
| # 2 | _____ | Kentucky (b.) |
| # 3 | _____ | Pennsylvania (c.) |
| # 4 | _____ | West Virginia (d.) |
| # 5 | _____ | Wyoming (e.) |

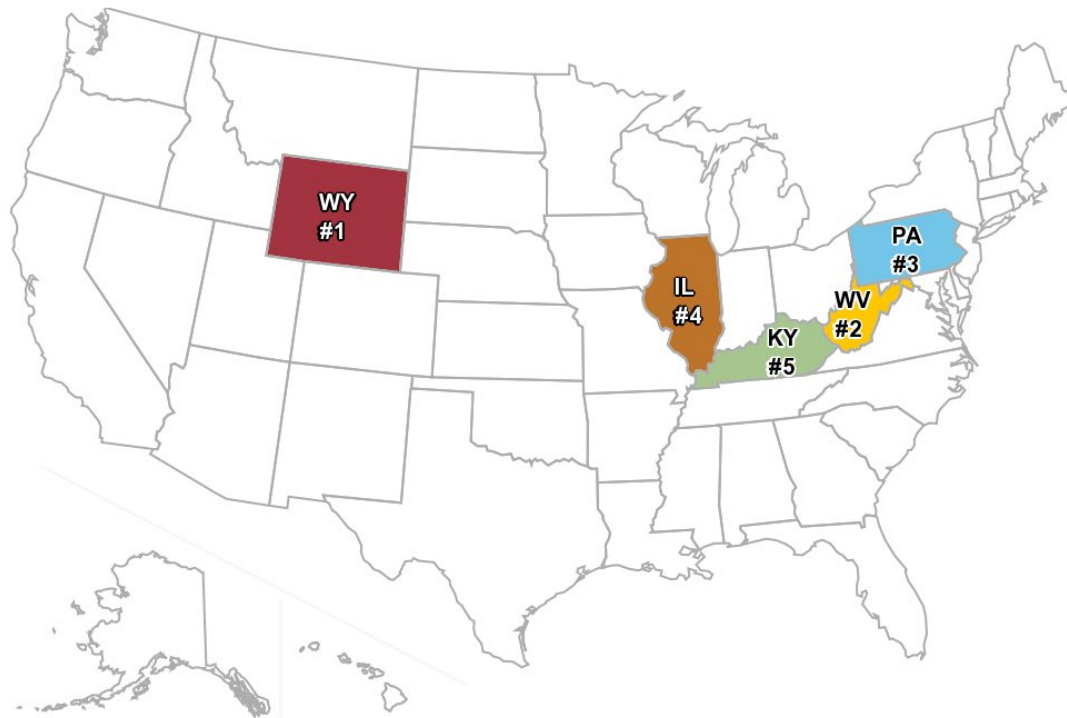
Question 15 Answer

15. Rank the following states in order of their coal production.

1 Wyoming (e.)

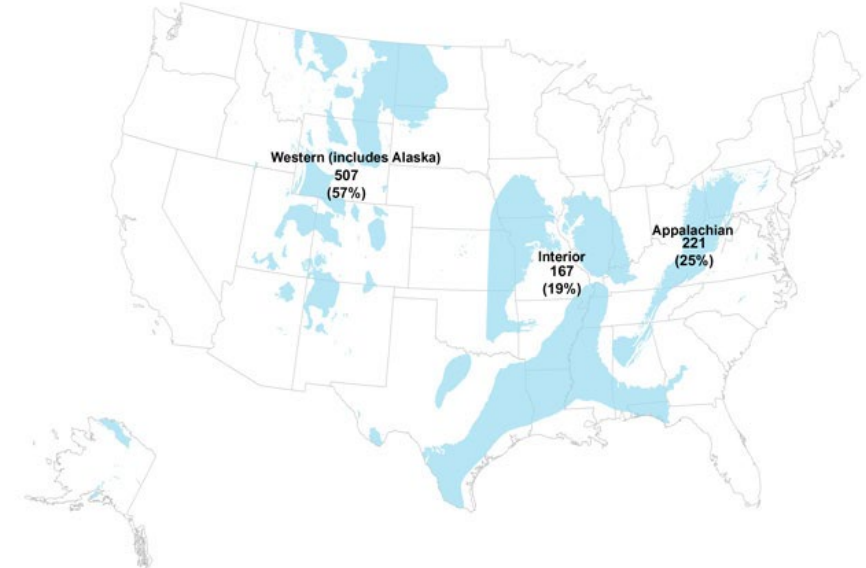
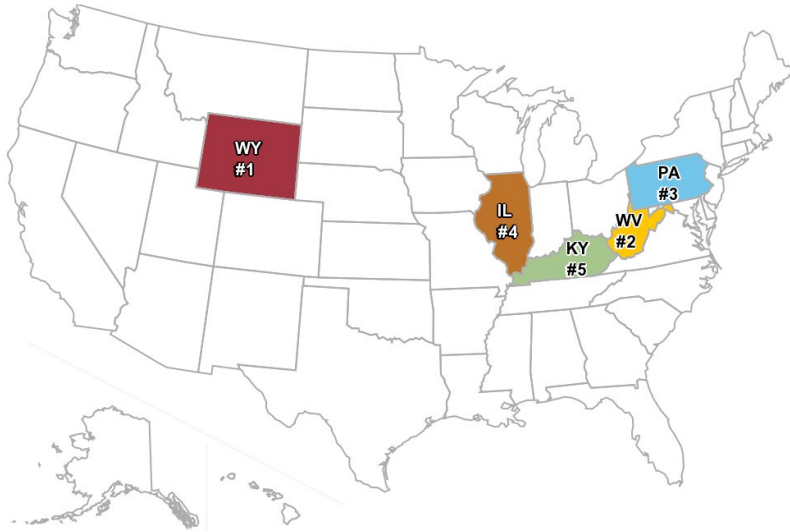
Top five coal-producing states in 2018

Top five coal producing states, 2018



Coal Production Maps

Coal production by region in million short tons and regional share of total production, 2015



Note: Excludes refuse recovery coal. Sum of shares may not equal 100% because of independent rounding.

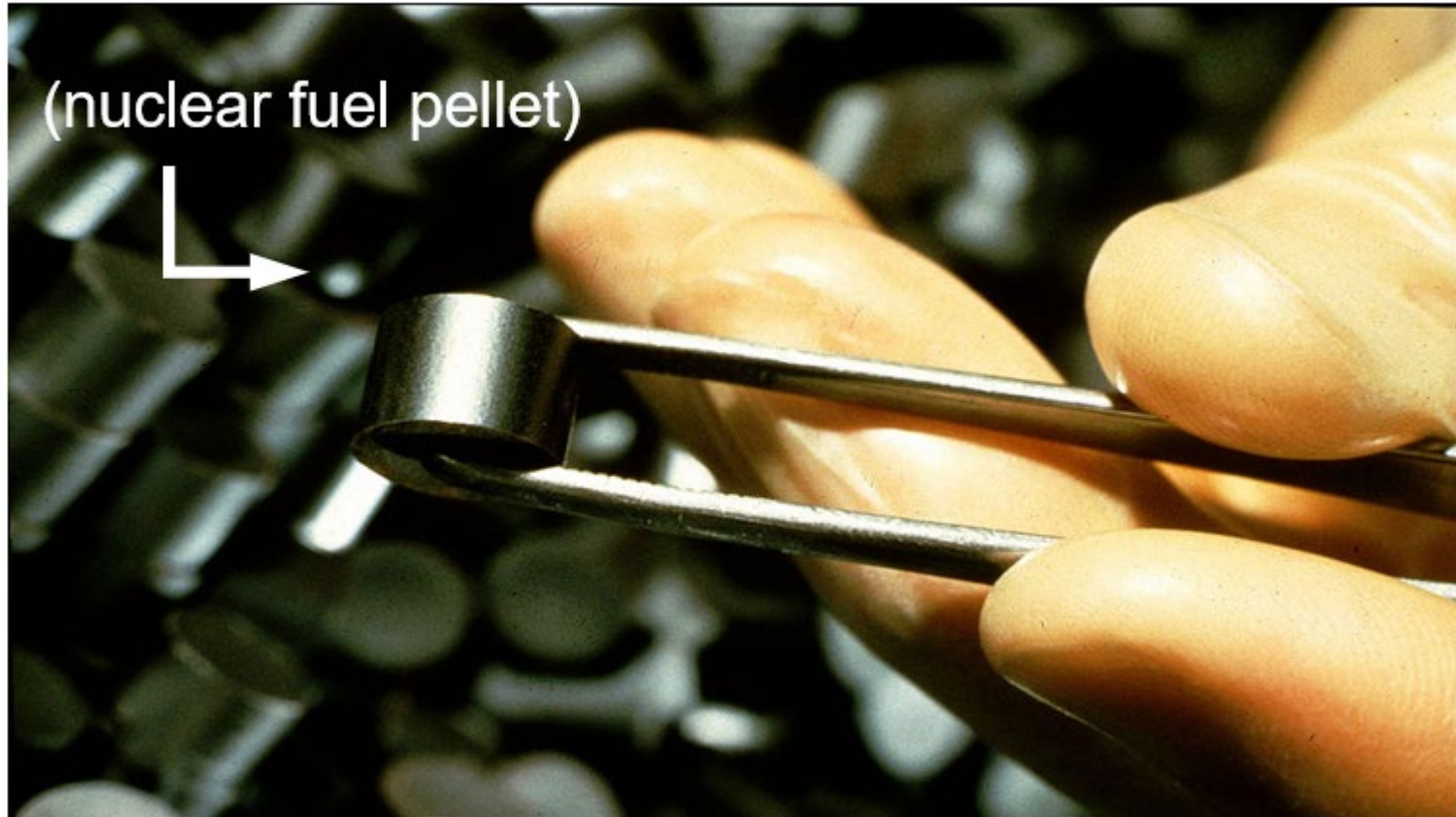
Source: U.S. Energy Information Administration, *Annual Coal Report*, November 2016

Question 15 All Answers

15. Rank the following states in order of their coal production.

- # 1 Wyoming (e.)
- # 2 West Virginia (d.)
- # 3 Pennsylvania (c.)
- # 4 Illinois (a.)
- # 5 Kentucky (b.)

Nuclear Power

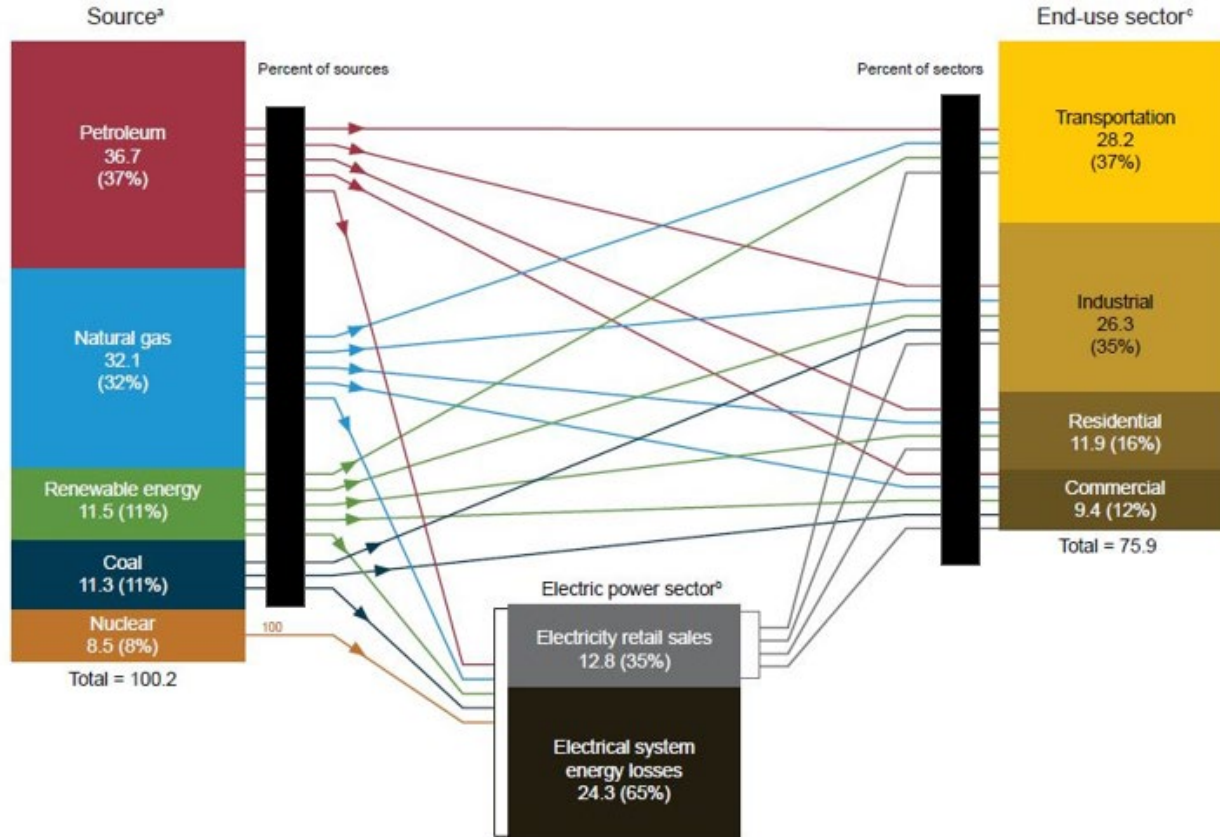


Question 16

16. All of America's nuclear power (100%) goes to which sector of the economy:
- a. Commercial
 - b. Electric Power
 - c. Industrial
 - d. Residential
 - e. Transportation

Nuclear Source

U.S. energy consumption by source and sector, 2019
(Quadrillion Btu)



Question 16 Answer

16. All of America's nuclear power (100%) goes to which sector of the economy:

Correct Answer:

b. Electric Power

Question 17

17. The atomic fuel used in the process of generating nuclear power is an isotope of (Isotope – mass):

- a. Hydrogen – 1
- b. Hydrogen – 2
- c. Hydrogen – 3
- d. Uranium – 235
- e. Uranium – 238

Uranium

Uranium – 235 fuel pellets

Nuclear reactor grade **U – 235** is “enriched” (concentrated) to between 3 – 5 %.

At this concentration it cannot explode like an atomic bomb.



Question 17 Answer

17. The atomic fuel used in the process of generating nuclear power is an isotope of (Isotope – mass):

Correct Answer:

d. Uranium – 235

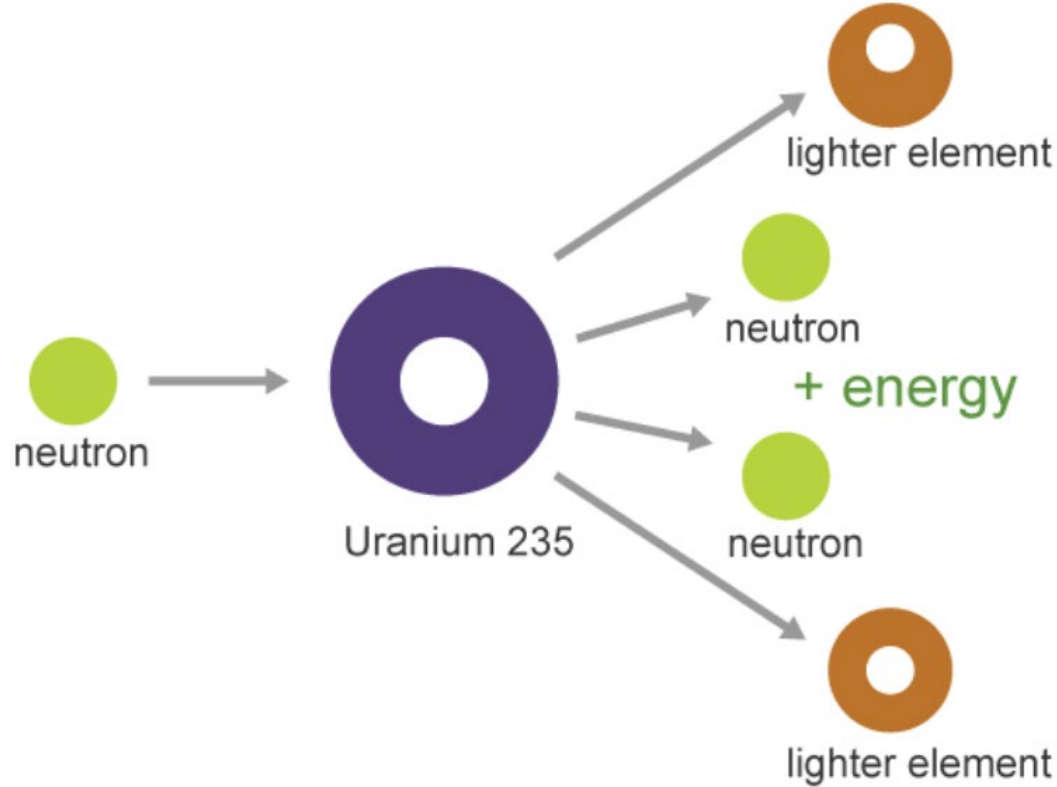


Question 18

18. Nuclear fission releases enormous amounts of energy when the forces holding the nucleus of certain atoms together are broken. Which equation below is an example of a nuclear fission equation?

- a. $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{radiant energy (sunlight)} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- b. a neutron + U-235 \rightarrow Ba-140 + Kr-93 + 3 neutrons + energy
- c. H-2 + H-3 \rightarrow He-4 + a neutron + radiant energy (sunlight)
- d. $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

How fission splits the uranium atom



Source: Adapted from National Energy Education Development Project
(public domain)

Question 18 Answer

18. Nuclear fission releases enormous amounts of energy when the forces holding the nucleus of certain atoms together are broken. Which equation below is an example of a nuclear fission equation?

Correct Answer:

b. a neutron + U-235 → Ba-140 + Kr-93 + 3 neutrons + energy

Question 19

19. Where does the United States get its Uranium-235? Rank these countries in order of their share of U-235 supplied to the US.

- | | | |
|-----------|-------|---------------------|
| # 1 (24%) | _____ | Australia (a.) |
| # 2 (20%) | _____ | Canada (b.) |
| # 3 (18%) | _____ | Kazakhstan (c.) |
| # 4 (13%) | _____ | Russia (d.) |
| # 5 (10%) | _____ | U.S. Suppliers (e.) |

Question 19 Answer 1

19. Where does the United States get its Uranium-235? Rank these countries in order of their share of U-235 supplied to the US.

1 (24%) Canada (b.)

Sources and Shares of Total U.S. Purchases of Uranium

Sources and Shares of Total U.S. Purchases of Uranium in 2018 were:

24% Canada

20% Kazakhstan

18% Australia

13% Russia

10% U.S. suppliers

6% Uzbekistan

5% Namibia

3% China, Niger, South

African and others combined



Question 19 All Answers

19. Where does the United States get its Uranium-235? Rank these countries in order of their share of U-235 supplied to the US.

- # 1 (24%) Canada (b.)
- # 2 (20%) Kazakhstan (c.)
- # 3 (18%) Australia (a.)
- # 4 (13%) Russia (d.)
- # 5 (10%) U.S. Suppliers (e.)

Question 20

20. Rank the following states in order of their percentage of electricity generated by nuclear power.

- | | | |
|-----------|-------|---------------------|
| # 1 (61%) | _____ | Connecticut (a.) |
| # 2 (56%) | _____ | Illinois (b.) |
| # 3 (54%) | _____ | New Hampshire (c.) |
| # 4 (44%) | _____ | South Carolina (d.) |
| # 5 (42%) | _____ | Tennessee (e.) |

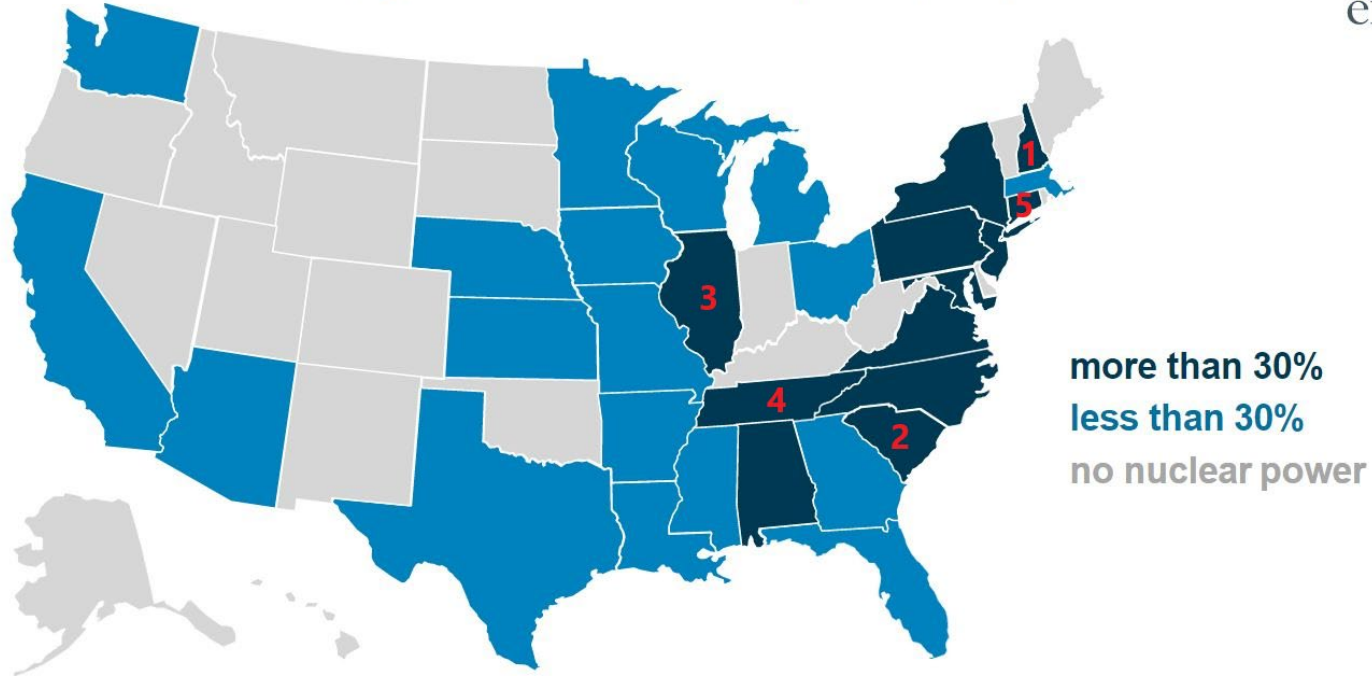
Question 20 Answer 1

20. Rank the following states in order of their percentage of electricity generated by nuclear power.

1 (61%) New Hampshire (c.)

Nuclear Power Map

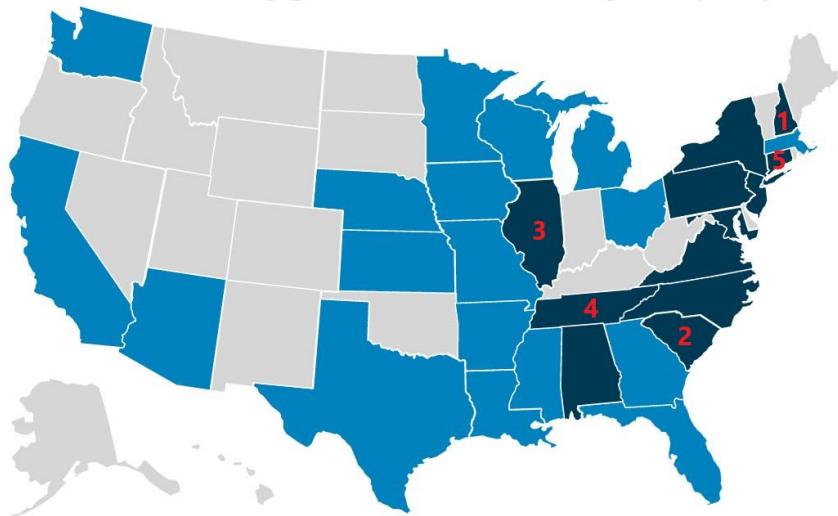
Share of state electricity generation from nuclear power (2019)



Source: U.S. Energy Information Administration, *Electric Power Monthly*

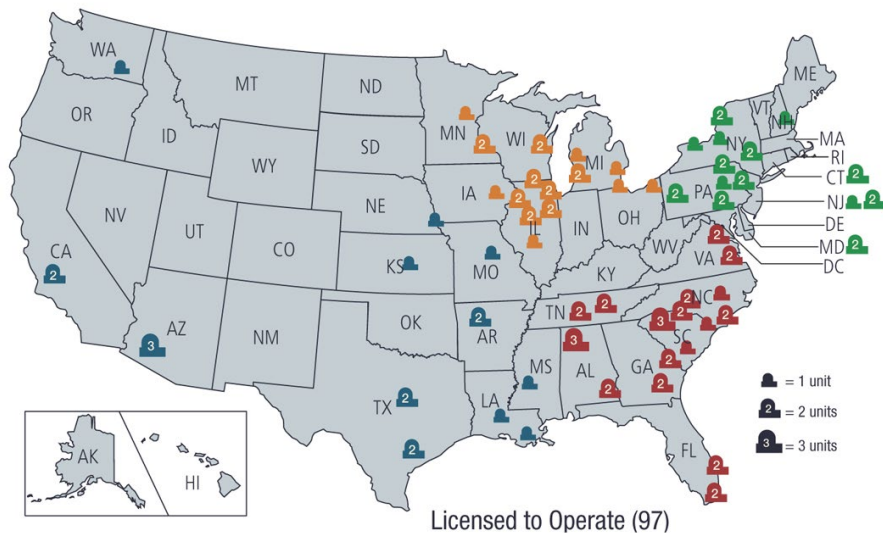
Nuclear Power and Reactor Maps

Share of state electricity generation from nuclear power (2019)



Source: U.S. Energy Information Administration, *Electric Power Monthly*

U.S. Operating Commercial Nuclear Power Reactors



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment
As of August 2019

Question 20 All Answers

20. Rank the following states in order of their percentage of electricity generated by nuclear power.

- | | |
|-----------|---------------------|
| # 1 (61%) | New Hampshire (c.) |
| # 2 (56%) | South Carolina (d.) |
| # 3 (54%) | Illinois (b.) |
| # 4 (44%) | Tennessee (e.) |
| # 5 (42%) | Connecticut (a.) |

Miscellaneous



Question 21

21. Match the home energy uses to the percent of energy each is responsible for consuming in the average American home:

- | | | |
|-----------|-------|-----------------------|
| # 1 (17%) | _____ | Air Conditioning (a.) |
| # 2 (15%) | _____ | Lighting (b.) |
| # 3 (14%) | _____ | Refrigeration (c.) |
| # 4 (10%) | _____ | Space Heating (d.) |
| # 5 (7%) | _____ | Water Heating (e.) |

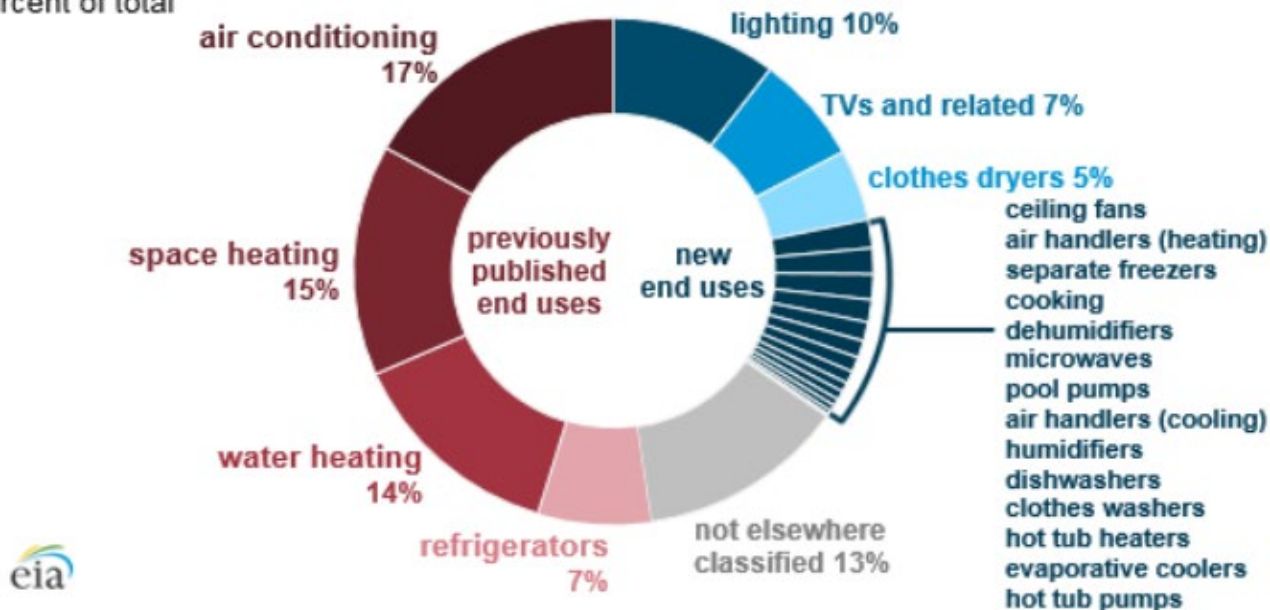
Question 21 Answer 1

21. Match the home energy uses to the percent of energy each is responsible for consuming in the average American home:

1 (17%) Air Conditioning (a.)

Residential Electricity Consumption by end use in 2015

Residential electricity consumption by end use, 2015
percent of total



Question 21 All Answers

21. Match the home energy uses to the percent of energy each is responsible for consuming in the average American home:

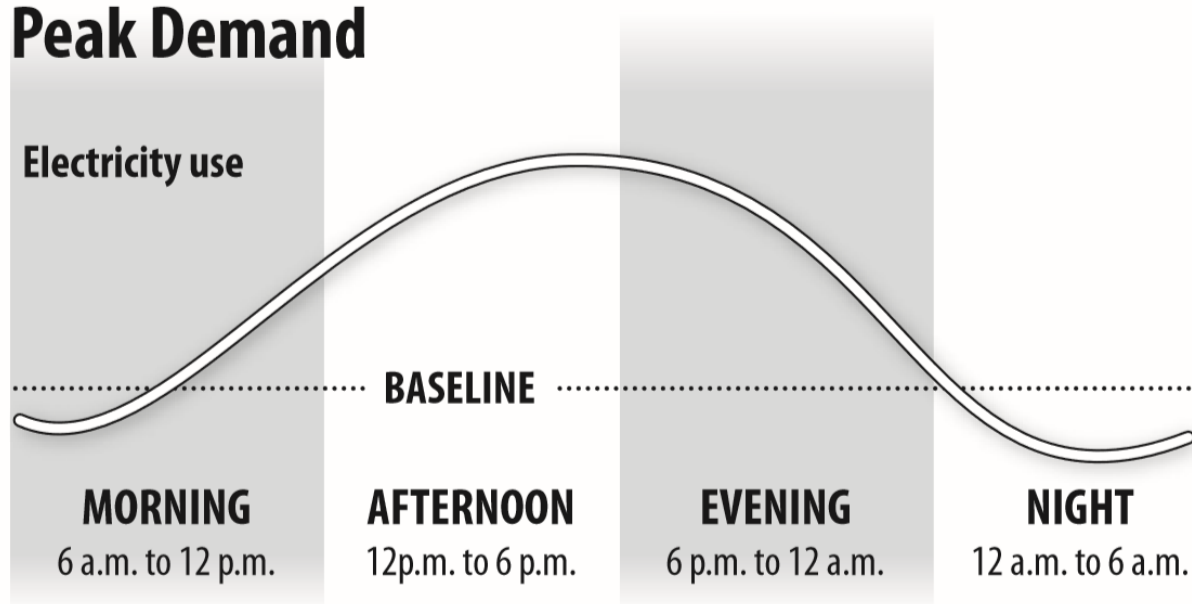
- | | |
|-----------|-----------------------|
| # 1 (17%) | Air Conditioning (a.) |
| # 2 (15%) | Space Heating (d.) |
| # 3 (14%) | Water Heating (e.) |
| # 4 (10%) | Lighting (b.) |
| # 5 (7%) | Refrigeration (c.) |

Question 22

22. On average, during which time of day is the greatest quantity of energy demanded and used in America:

- a. Morning, 6 am – noon
- b. Afternoon, noon – 6 pm
- c. Evening, 6 pm – midnight
- d. Night, midnight – 6 am

Peak Demand



Peak demand, also called peak load, is the maximum load during a specified period of time.

Question 22 Answer

22. On average, during which time of day is the greatest quantity of energy demanded and used in America:

Correct Answer:

b. Afternoon, noon – 6 pm

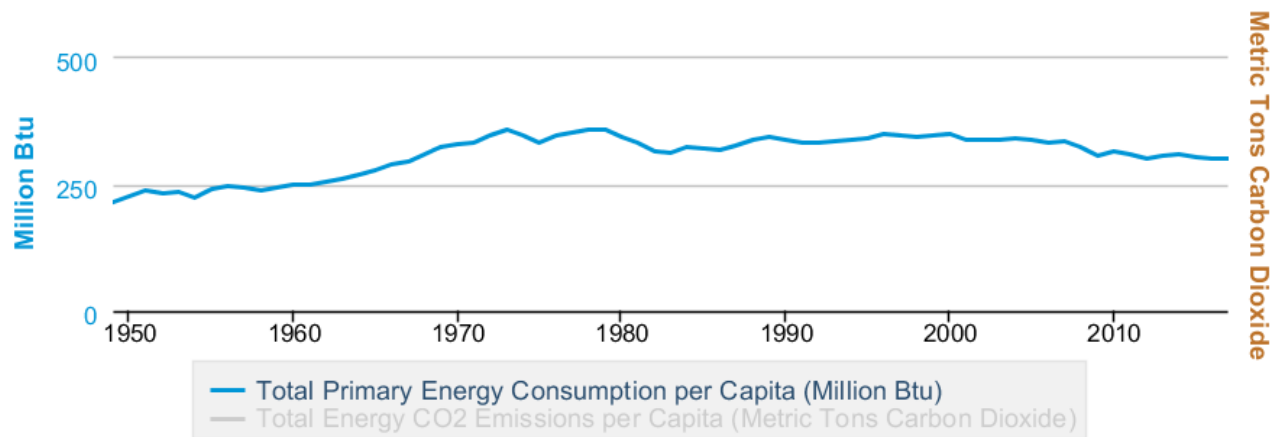
Question 23

23. In general, over the last 50 years, energy consumption per person in the United States has:

- a. increased dramatically
- b. increased slightly
- c. remained about the same
- d. decreased slightly
- e. decreased dramatically

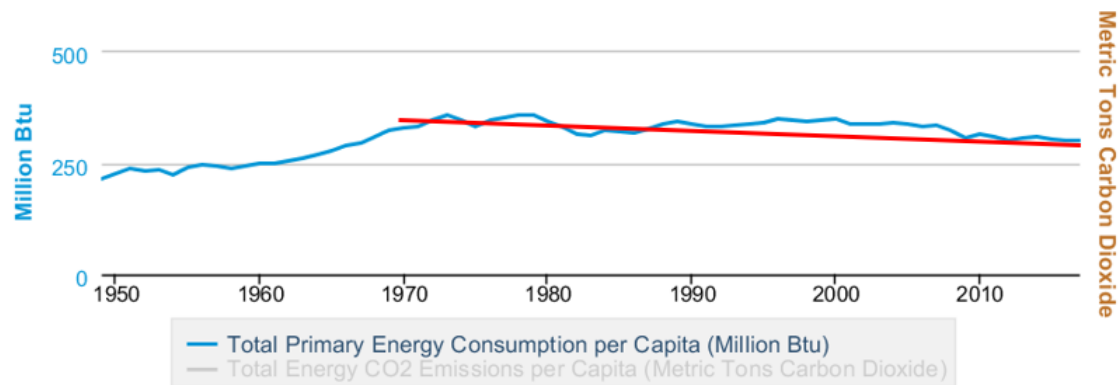
Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emission Indicators (1)

Table 1.7 Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emissions Indicators



Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emission Indicators (2)

Table 1.7 Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emissions Indicators



Data source: U.S. Energy Information Administration

Question 23 Answer

23. In general, over the last 50 years, energy consumption per person in the United States has:

Correct Answer:

d. decreased slightly

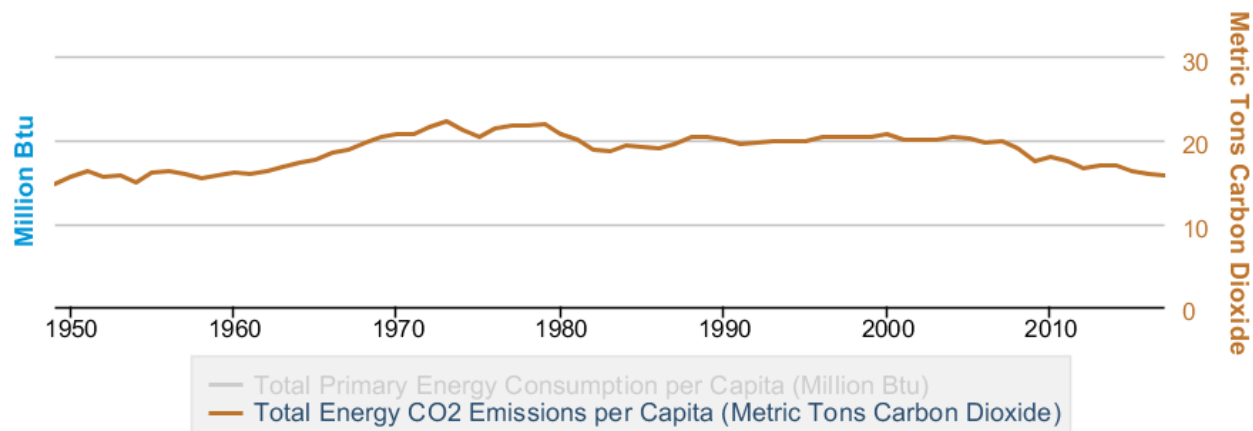
Question 24

24. In general, over the last 50 years, carbon dioxide (CO₂) emissions per person in the United States have:

- a. increased dramatically
- b. increased slightly
- c. remained about the same
- d. decreased slightly
- e. decreased dramatically

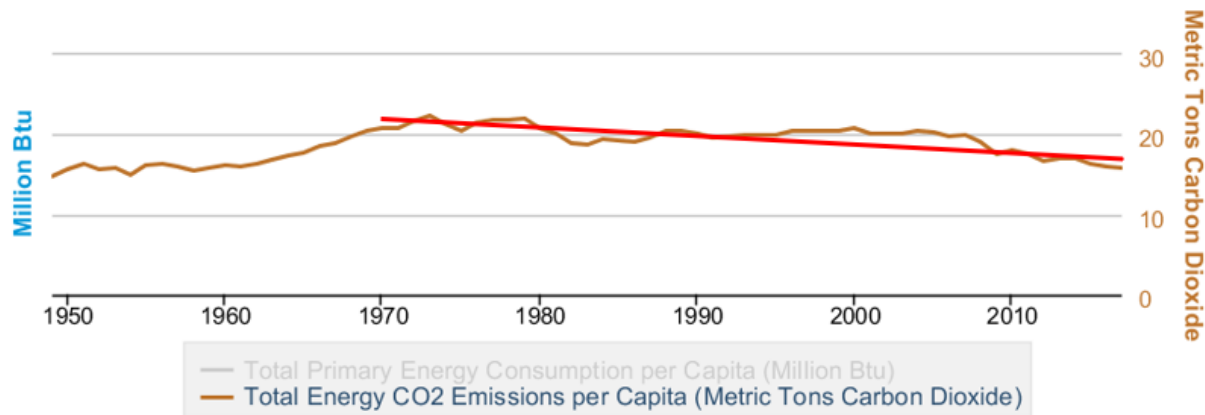
Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emission Indicators (3)

Table 1.7 Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emissions Indicators



Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emission Indicators (4)

Table 1.7 Primary Energy Consumption, Energy Expenditures, and Carbon Dioxide Emissions Indicators



Data source: U.S. Energy Information Administration

Question 24 Answer

24. In general, over the last 50 years, carbon dioxide (CO₂) emissions per person in the United States have:

Correct Answer:

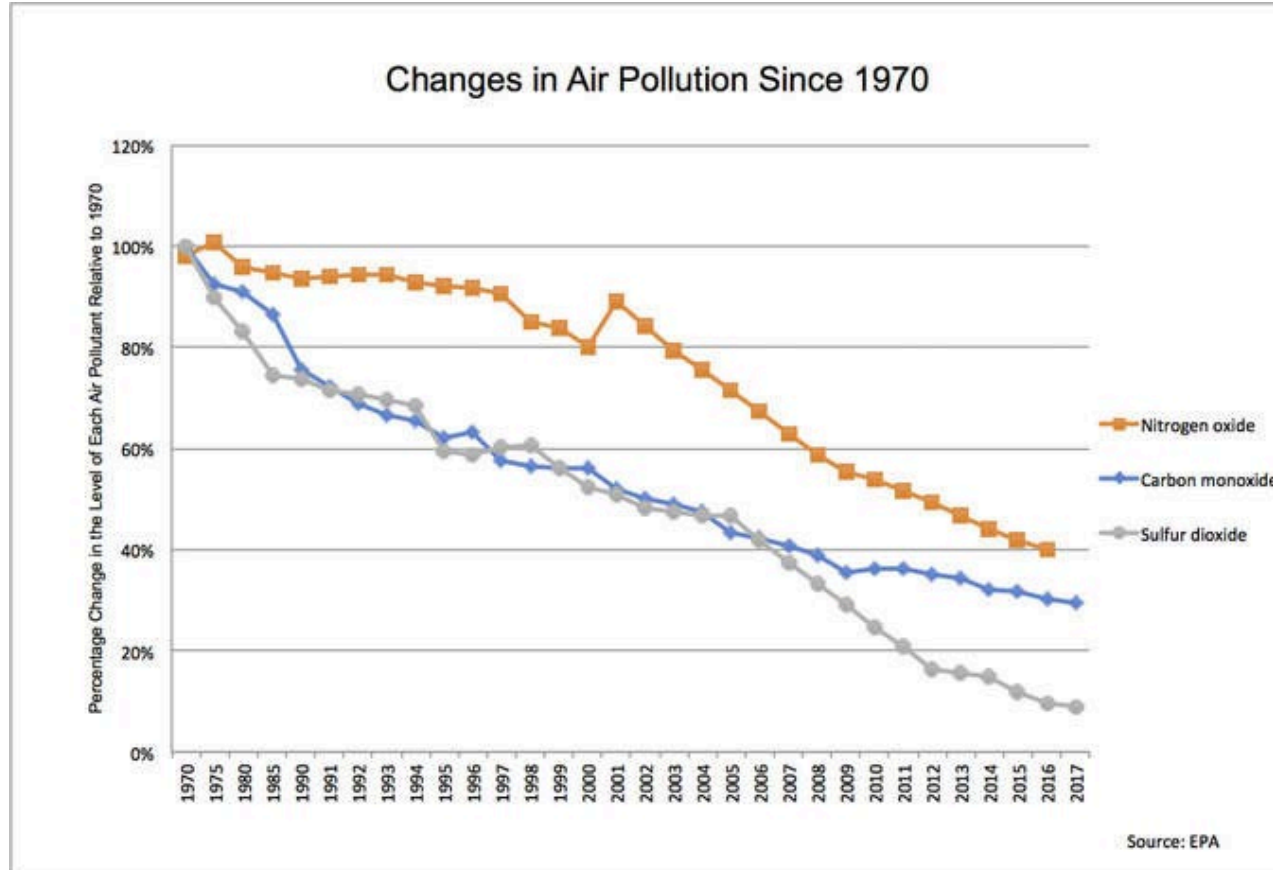
d. decreased slightly

Question 25

25. In general, overall emissions of sulfur dioxide, nitrogen oxide, and carbon monoxide during the last 50 years in the United States have:

- a. increased dramatically
- b. increased slightly
- c. remained about the same
- d. decreased slightly
- e. decreased dramatically

Changes in Air Pollution Since 1970



Question 25 Answer

25. In general, overall emissions of sulfur dioxide, nitrogen oxide, and carbon monoxide during the last 50 years in the United States have:

Correct Answer:

e. decreased dramatically

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By the Numbers II

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