

Chapter 02 - Protecting the Ozone Layer (Testbank)

Student: _____

1. How many protons, neutrons, and electrons are there in a neutral atom of $^{19}_9\text{F}$?

	# protons	# neutrons	# electrons
A.	10	9	10
B.	9	9	9
C.	10	9	9
D.	9	10	9

- A. A
B. B
C. C
D. D
2. Which color in the rainbow has the shortest wavelength?
- A. orange
B. red
C. yellow
D. blue
3. The wavelength of light in the visible range is
- A. about the size of an atom of carbon.
B. intermediate between the size of an animal cell and a virus.
C. about the diameter of a CD.
D. intermediate between the size of an animal cell and the diameter of a CD.
4. Which is correct?
- A. Ozone forms by combining an oxygen atom with an oxygen molecule.
B. There is a dynamic steady state of ozone in the stratosphere.
C. UV radiation will dissociate ozone into an oxygen atom and an oxygen molecule.
D. All of these choices are correct.

5. Which statement is correct?
- A. UV-A is the most energetic of the three forms of UV light.
 - B. UV-B is the most energetic of the three forms of UV light.
 - C. UV-C is the most energetic of the three forms of UV light.
 - D. UV-A, UV-B, and UV-C are equally energetic.
6. During the Antarctic spring, ozone is destroyed at a greater rate than it is formed
- A. on the surface of atmospheric ice crystals.
 - B. in a process that is catalytic.
 - C. in polar stratospheric clouds.
 - D. All of these choices are correct.
7. The goal of the Montreal Protocol in 1987 was to
- A. reduce the amount of new production of chlorofluorocarbons in developed countries.
 - B. recycle existing chlorofluorocarbons rather than release them into the air.
 - C. encourage research into substitutes for chlorofluorocarbons.
 - D. All of these choices are correct.
8. HFCs may be used to replace CFCs. Which compound is a HFC?
- A. $\text{CH}_2\text{Cl}-\text{CCl}_2\text{F}$
 - B. CH_2FCI
 - C. $\text{CF}_3\text{CH}_2\text{F}$
 - D. CHClF_2
9. The speed of light in air
- A. depends only on the frequency of the light.
 - B. depends only on the wavelength of light.
 - C. is independent of the wavelength and frequency of light.
 - D. depends on both the wavelength and the frequency of light.
10. DNA, the genetic material of living organisms, is damaged by light in the
- A. visible region of the spectrum.
 - B. ultraviolet region, especially below a wavelength of 320 nm.
 - C. ultraviolet region, especially above a wavelength of 340 nm.
 - D. infrared region of the spectrum.

11. The ozone hole is most prominent on the Earth over

- A. North America.
- B. Europe.
- C. Africa.
- D. Antarctica.

12. Which contributes to the ozone hole?

- A. automobile exhaust
- B. chlorofluorocarbons (CFCs)
- C. loss of Northern forests
- D. All of these choices are correct.


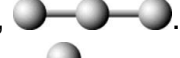
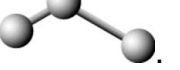

13. Ozone in our atmosphere is important because it

- A. absorbs some UV radiation.
- B. helps trees grow.
- C. reacts with excess CO₂.
- D. reflects IR radiation.

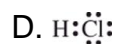
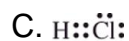
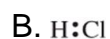
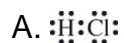
14. Wavelength is the

- A. number of waves passing a fixed point in one second.
- B. height of the wave.
- C. distance between successive peaks in a wave.
- D. distance between a peak of one wave and the next trough.

15. The structure of ozone most closely resembles a

- A. linear molecule with different lengths of chemical bonds, for example, .
- B. linear molecule with the same length of chemical bonds, for example, .
- C. bent molecule with different lengths of chemical bonds, for example, .
- D. bent molecule with the same length of chemical bonds, for example, .

16. The correct Lewis structure for HCl is:



17. As the ozone hole gets more pronounced, with time, one expects the incidence of skin cancer to

A. decrease worldwide.

B. increase worldwide.

C. increase in the northern hemisphere and decrease in the southern hemisphere.

D. decrease in the northern hemisphere and decrease in the northern hemisphere.

18. The Montreal protocol is a

A. treaty to protect against global warming.

B. treaty to reduce the amount of CFCs produced in the world.

C. list of substitutes for CFCs.

D. way to destroy CFCs in the stratosphere.

19. What is the relationship between stratospheric levels of atomic chlorine and ozone?

A. As chlorine increases, ozone increases.

B. As chlorine increases, ozone decreases.

C. As chlorine changes, the effect on the ozone level is unpredictable.

D. As chlorine changes, there is no effect of the ozone level.

20. In the periodic table, which elements typically have similar properties?

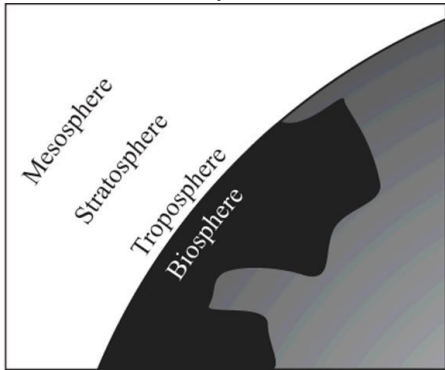
A. those in the same rows

B. those related diagonally

C. those in the same columns

D. those on opposite sides

21. In Earth's atmosphere, where is the ozone layer?



- A. troposphere
- B. biosphere
- C. mesosphere
- D. stratosphere

22. The nucleus of an atom contains

- A. electrons and protons only.
- B. protons only.
- C. electrons, protons, and neutrons.
- D. protons and neutrons only.

23. What distinguishes the atoms of one element from another?

- A. the number of neutrons
- B. the number of protons plus neutrons
- C. the number of protons
- D. the number of neutrons plus electrons

24. When it reaches its largest size, the ozone hole over the Antarctic is

- A. about as large as North America.
- B. about the same size as France.
- C. smaller than Iceland.
- D. about the same size as Canada.

25. Elements in the same column of the periodic table in the Groups labeled A tend to have similar chemical and physical properties because they have the same number of

- A. outer (valence) electrons.
- B. protons.
- C. protons plus electrons.
- D. protons plus neutrons.

26. Isotopes of an element have the same number of _____, but different numbers of _____.

- A. electrons; protons
- B. protons; neutrons
- C. neutrons; protons
- D. protons; electrons

27. When only one pair of shared electrons is involved in a covalent bond, the linkage is called a _____ bond.

- A. triple
- B. single
- C. double
- D. resonant

28. The atomic number is the

- A. same as the mass number of an atom.
- B. number of protons in a nucleus.
- C. number of protons and neutrons in a nucleus.
- D. number of neutrons in a nucleus.

29. How many protons, neutrons, and electrons are there in the neutral atom of $^{13}_6\text{C}$?

	# protons	# neutrons	# electrons
A.	7	6	7
B.	7	13	6
C.	6	7	6
D.	6	7	13

- A. A
- B. B
- C. C
- D. D

30. Increasing wavelength of light goes in this order:

- A. ultraviolet > visible > infrared.
- B. visible > infrared > ultraviolet.
- C. infrared > visible > ultraviolet.
- D. ultraviolet > infrared > visible.

31. The wavelength of light in the X-ray region of the electromagnetic spectrum is

- A. smaller than a virus.
- B. intermediate between the size of a bacterial cell and a virus.
- C. about the size of a bacterial cell.
- D. larger than either a bacterial cell or a virus.

32. Which is one of the Lewis structures for ozone?



33. Stratospheric ozone is destroyed and formed at the same rate

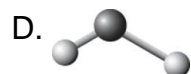
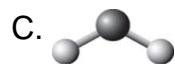
- A. above the equator.
- B. above the Antarctic in its early spring.
- C. above the Antarctic in its early fall.
- D. above the equator and above the Antarctic in its early fall.

34. The mass number of an isotope of an element is the

- A. sum of the number of its protons and electrons.
- B. number of its protons.
- C. sum of the number of its protons and neutrons.
- D. sum of the number of its protons, neutrons, and electrons.

35. It is the _____ electrons that account for many of the chemical and physical properties of elements.
- A. innermost
 - B. intermediate
 - C. outermost
 - D. transitional
36. Single bonds, double bonds, and triple bonds
- A. have 1, 2, and 3 shared electrons, respectively.
 - B. have 2, 4, and 6 shared electrons, respectively.
 - C. have 3, 6, and 9 shared electrons, respectively.
 - D. are only possible between carbon atoms.
37. Light behaves like
- A. a particle.
 - B. a wave.
 - C. both a particle and a wave.
 - D. neither a particle nor a wave.
38. The "ozone layer" is found
- A. only around the equator.
 - B. in the troposphere.
 - C. in the stratosphere.
 - D. in the mesosphere.
39. In reference to waves, frequency is the
- A. number of waves passing a fixed point in one second.
 - B. height of the wave.
 - C. distance between successive peaks in a wave.
 - D. distance between a peak in a wave to the next trough.

40. The two chemical bonds and geometry of water are best represented by:



41. Which is/are part of the Chapman cycle in the stratosphere?

- I. Ozone is removed by its reaction with water vapor.
- II. Ozone is removed by an interaction with UV radiation.
- III. Ozone reacts with oxygen atoms to form oxygen molecules.

- A. I only
- B. II only
- C. I, II and III
- D. II and III only

42. Free radicals are

- A. highly reactive chemical species.
- B. species with unpaired electrons.
- C. species such as $\text{H}\cdot$ and $\cdot\text{OH}$.
- D. All of these correctly describe free radicals.

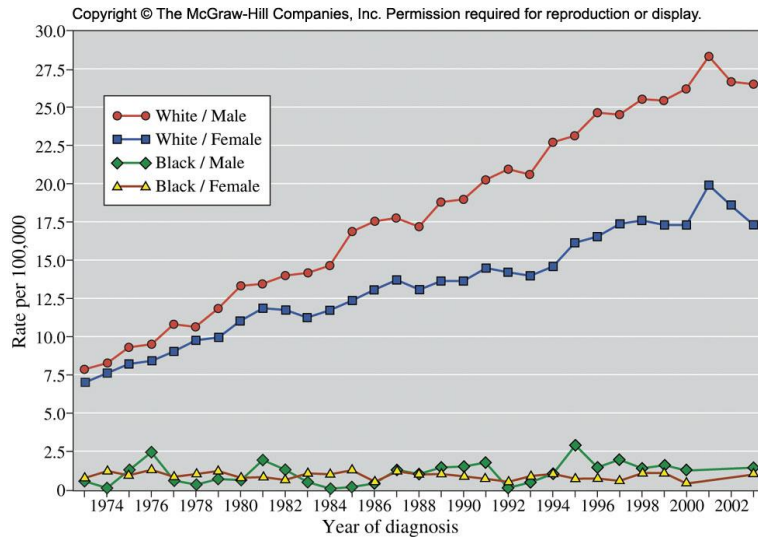
43. Chlorofluorocarbons rise to the stratosphere and

- A. react directly with stratospheric ozone to destroy it.
- B. interact with UV energy to produce free radicals that destroy ozone.
- C. interact with UV energy to produce free radicals that react with oxygen to create ozone.
- D. react with free radicals to remove carbon dioxide.

44. Decreased stratospheric ozone concentrations may lead to
- A. increased incidences of melanomas.
 - B. harm to young marine life.
 - C. an increased occurrence of cataracts.
 - D. All of these choices are correct.
45. Two isotopes of a particular element differ from one another by the number of
- A. neutrons.
 - B. protons.
 - C. protons, neutrons, and electrons.
 - D. protons plus electrons.
46. The chemical properties of the elements are chiefly due to the number
- A. of protons.
 - B. and distribution of the outer electrons.
 - C. and distribution of the inner electrons.
 - D. and distribution of the neutrons.
47. Results of the Montreal protocol include
- A. greatly reduced production of CFCs.
 - B. increased production of alternatives to CFCs.
 - C. recycling of CFCs.
 - D. All of these choices are correct.
48. Halons differ from CFCs in that the atoms of _____ replace some _____ atoms.
- A. iodine; chlorine
 - B. hydrogen; chlorine
 - C. bromine; chlorine
 - D. silicon; carbon
49. Yellow light has a wavelength of 580 nm. What is the frequency of this light?
- A. $2.39 \times 10^{-19} \text{ s}^{-1}$
 - B. $1.80 \times 10^{-7} \text{ s}^{-1}$
 - C. $5.17 \times 10^5 \text{ s}^{-1}$
 - D. $5.17 \times 10^{14} \text{ s}^{-1}$

50. WUKF FM transmits at 93.5 MHz. What is the wavelength of the electromagnetic radiation that carries the station's signal?
- A. 6.42×10^{-9} m
 - B. 3.21 m
 - C. 3.21×10^6 m
 - D. 3.12×10^{15} m
51. UV-B radiation has a frequency of approximately 10^{17} s^{-1} . What is the energy of a photon of this light?
- A. 1.99×10^{-42} J
 - B. 6.63×10^{-17} J
 - C. 4.19×10^8 J
 - D. 1.51×10^{50} J
52. Which region of the ultraviolet spectrum is absorbed least by the atmosphere?
- A. UV-A
 - B. UV-B
 - C. UV-C
 - D. They are all absorbed approximately equally.

53. From 1974 to 2002, the chance that a white male would be diagnosed with melanoma skin cancer rose by

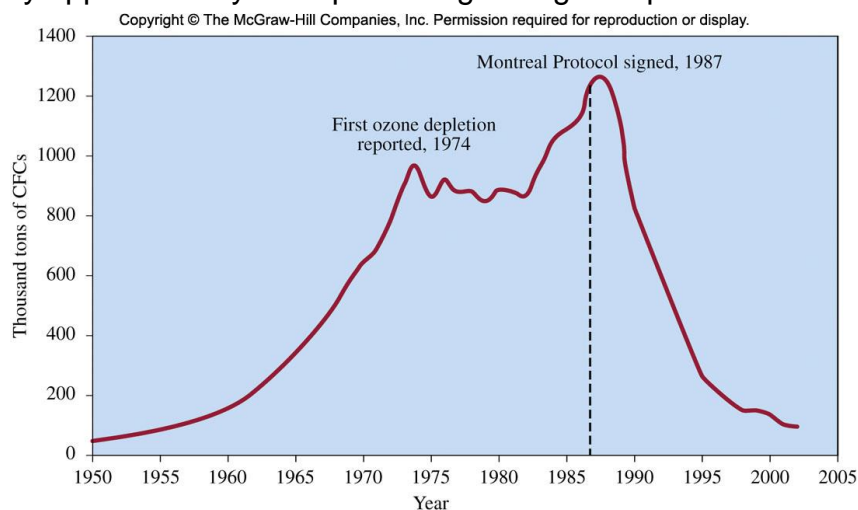


- A. 18%.
- B. 31%.
- C. 100%.
- D. 225%.

54. In the Chapman cycle, ozone formation depends upon a sufficient concentration of oxygen atoms. Which step in the Chapman cycle produces oxygen atoms?

- A. absorption of light ($\lambda \leq 320$ nm) by ozone molecules
- B. absorption of light ($\lambda \leq 320$ nm) by oxygen molecules
- C. absorption of light ($\lambda \leq 242$ nm) by ozone molecules
- D. absorption of light ($\lambda \leq 242$ nm) by oxygen molecules

55. By approximately what percentage did global production of CFCs fall from 1987 to 2000?



- A. 13%
- B. 44%
- C. 88%
- D. 1100%

56. Which product of the ultraviolet decomposition of CFCs acts as the catalyst for ozone decomposition?

- A. oxygen atoms
- B. chlorine atoms
- C. fluorine atoms
- D. hydrogen atoms

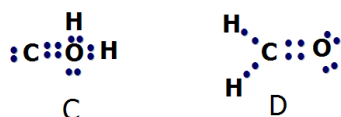
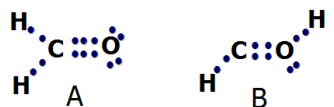
57. HCFCs have been developed to replace CFCs as refrigerants. Which property of these new compounds makes them environmentally superior to CFCs?

- A. Greater reactivity leads to decomposition at elevations below the stratospheric ozone concentration maximum.
- B. Lower reactivity makes them stable even in the intense ultraviolet light in the stratosphere.
- C. Their higher molecular weight prevents them from reaching the stratosphere.
- D. They do not contain chlorine.

58. HCFCs are a temporary solution to the problem of ozone depletion and will be replaced over the next 20 years by which class of compounds?

- A. HFCs
- B. CFCs
- C. halons
- D. HFBCs

59. Which Lewis structure for formaldehyde (CH_2O) is correct?



- A. A
- B. B
- C. C
- D. D

60. Why are HFCs environmentally superior to the currently used HCFCs?

- A. HFCs are not flammable.
- B. HFCs do not contain chlorine.
- C. HFCs are lighter and may be transported more easily.
- D. HFCs are less reactive than HCFCs.

61. CFCs were originally developed to replace which refrigerant compound(s)?

- A. ice
- B. HCFCs
- C. ammonia and sulfur dioxide
- D. propane

62. How many protons, neutrons, and electrons are in a neutral atom of ^{64}Cu (atomic number = 29)?
- A. Protons = 64, neutrons = 29, electrons = 29
 - B. Protons = 35, neutrons = 29, electrons = 35
 - C. Protons = 29, neutrons = 64, electrons = 35
 - D. Protons = 29, neutrons = 35, electrons = 29
63. The O_2 molecule breaks apart at lower wavelengths than the O_3 molecule. What is the main reason for this? (Hint: Draw the Lewis structures)
- A. O_2 is more reactive than O_3
 - B. O_3 is more reactive than O_2
 - C. The average bond in O_3 is shorter and stronger than that of O_2
 - D. The average bond in O_2 is shorter and stronger than that of O_3
64. Which of the following compounds is useful for putting out fires and does not deplete stratospheric ozone concentrations?
- A. Halon-1211
 - B. CFC-113
 - C. HFCs
 - D. Methyl Bromide
65. Why are HFCs inappropriate for long-term replacement of CFCs?
- A. They are flammable.
 - B. They are very toxic.
 - C. They absorb infrared radiation.
 - D. They are an appropriate replacement.
66. In what year will all production and importation of HCFCs end in the United States?
- A. 2012
 - B. 2020
 - C. 2030
 - D. 2015

67. What is the role of polar stratospheric clouds (PSCs) on the destruction of ozone?
- A. The cold clouds react with ozone to make oxygen molecules and oxygen atoms.
 - B. Chemical reactions occur on the clouds that convert molecules that do no damage to those that deplete ozone.
 - C. They play no role.
 - D. The clouds are made of chlorine atoms from CFCs.
68. What is special about the South Pole versus the North Pole that leads to ozone depletion only at the south Pole?
- A. Ozone molecules are broken up by magnetic forces at the South Pole.
 - B. The atmosphere is colder at the North Pole than at the South Pole.
 - C. Polar stratospheric clouds form almost exclusively at the South Pole.
 - D. There is more land mass at the South Pole than at the North Pole.
69. Arrange these types of radiation in order of increasing energy per photon: gamma rays, infrared radiation, radio waves, visible light, UV (ultra violet)
- A. radio waves<visible light<UV <infrared radiation<gamma rays
 - B. radio waves< infrared radiation<visible light< UV<gamma rays
 - C. infrared radiation<radio waves<visible light < UV<gamma rays
 - D. gamma rays< infrared radiation<UV<radio waves< visible light
70. Which of the following is most biologically damaging type of radiation?
- A. UV-A
 - B. UV-B
 - C. UV-C
 - D. Infrared
71. The morning newspaper reports a UV Index Forecast of 6.5. What precautions, if any should a fair skinned person take?
- A. None.
 - B. Only sunglasses and maybe a hat is enough.
 - C. Reduce exposure between 10 a.m. and 4 p.m. in addition to SPF 15+ sunscreen.
 - D. All precautions must be taken; this is an extreme UV day.

Chapter 02 - Protecting the Ozone Layer (Testbank) Key

1. D
2. D
3. B
4. D
5. C
6. D
7. D
8. C
9. C
10. B
11. D
12. B
13. A
14. C
15. D
16. D
17. B
18. B
19. B
20. C
21. D
22. D
23. C
24. A
25. A
26. B
27. B
28. B
29. C

30. A
31. A
32. D
33. D
34. C
35. C
36. B
37. C
38. C
39. A
40. C
41. D
42. D
43. B
44. D
45. A
46. B
47. D
48. C
49. D
50. B
51. B
52. A
53. D
54. D
55. C
56. B
57. A
58. A
59. D
60. B
61. C

62. D

63. D

64. A

65. C

66. D

67. B

68. C

69. B

70. C

71. C

Chapter 02 - Protecting the Ozone Layer (Testbank)

Summary

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