Chapter 2
Protecting the Ozone Layer

Multiple Choice Questions

1. How many protons, neutrons, and electrons are there in a neutral atom of $^{19}_{9}F$?

	# 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

Remember that the mass is protons plus neutrons while protons must equal electrons for a neutral atom.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Atomic Mass
Subtopic: Atomic Symbol
Topic: Components of Matter

2. Which color in the rainbow has the shortest wavelength?

A. orange
B. red
C. yellow
D. blue

Remember ROY G. BIV to help with the colors from red (longest wavelength) to violet (shortest wavelength)

Bloom's Level: 3. Apply
Section: 02.04
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

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.

See fig 2.7 for information on the relationship between wavelengths and everyday items.

Bloom's Level: 3. Apply
Section: 02.04
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

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.

See fig 2.10 for a visual description of ozone's chemical cycling.

Bloom's Level: 2. Understand
Section: 02.06
Subtopic: Atmospheric Chemistry
Topic: Chemical Reactions
Topic: Environmental Chemistry

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.

See Table 2.4. Remember that UV-A has the longest wavelength while UV-C has the shortest wavelength

Bloom's Level: 2. Understand
Section: 02.04
Subtopic: Types of EM Radiation
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

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.

Think about the whole process. Is there more than one step?

Bloom's Level: 2. Understand
Section: 02.08
Subtopic: Atmospheric Chemistry
Topic: Chemical Reactions
Topic: Environmental Chemistry

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.

The Montreal Protocol had more than one goal.

Bloom's Level: 1. Remember
Section: 02.11
Topic: Environmental Chemistry

8. HFCs may be used to replace CFCs. Which compound is a HFC?

A. $CH_2Cl—CCl_2F$
B. CH_2FCl
C. CF_3CH_2F
D. $CHClF_2$

HFCs contain hydrogen in addition to Cl and F

Bloom's Level: 3. Apply
Section: 02.12
Subtopic: Atmospheric Chemistry
Subtopic: Chemical Formulas
Topic: Environmental Chemistry

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.

Remember that light can travel in vacuum and is a constant.

Bloom's Level: 3. Apply
Section: 02.04
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

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.

Damage by EM radiation usually occurs to structure that are of the same size as the wavelength of the radiation.

Bloom's Level: 3. Apply
Section: 02.07
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

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

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

Ozone is only destroyed over the Antarctic and the hole does not move far from its origin.

Bloom's Level: 1. Remember
Section: 02.08
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

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.

Only CFCs contain chlorine, which acts as a catalyst for ozone destruction. The others are environmental concerns, but don't contribute to the ozone hole.

Bloom's Level: 1. Remember
Section: 02.09
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

13. Ozone in our atmosphere is important because it

A. absorbs some UV radiation.
B. helps trees grow.
C. reacts with excess CO_2.
D. reflects IR radiation.

Remember that the ozone layer protects from sunburn, which is caused by exposure to UV radiation

Bloom's Level: 2. Understand
Section: 02.01
Section: 02.06
Subtopic: Atmospheric Chemistry
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

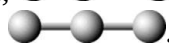
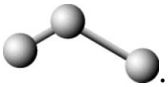
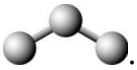
14. Wavelength is the

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.

See fig. 2.5

Bloom's Level: 2. Understand
Section: 02.04
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

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,  .

Remember the effects of lone pairs that repel each other and force the molecule into a bent shape.

Bloom's Level: 2. Understand
Section: 02.01
Subtopic: Atmospheric Chemistry
Subtopic: Chemical Formulas
Topic: Chemical Bonding
Topic: Environmental Chemistry
Topic: Study of Chemistry

16. The correct Lewis structure for HCl is:

A. 

B. H:Cl

C. 

D. 

All atoms must have an octet but hydrogen may only have two electrons.

Bloom's Level: 2. Understand
Section: 02.03
Subtopic: Lewis Dot Symbols
Subtopic: Molecules
Topic: Chemical Bonding

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.

Remember that ozone blocks UV radiation which causes skin damage.

Bloom's Level: 2. Understand
Section: 02.06
Subtopic: Atmospheric Chemistry
Topic: Chemical Reactions
Topic: Environmental Chemistry

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.

Remember that this treaty is about repairing the ozone hole.

Bloom's Level: 1. Remember
Section: 02.11
Section: 02.12
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

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.

Remember that chlorine works to destroy ozone.

Bloom's Level: 2. Understand
Section: 02.11
Topic: Chemical Reactions
Topic: Study of Chemistry

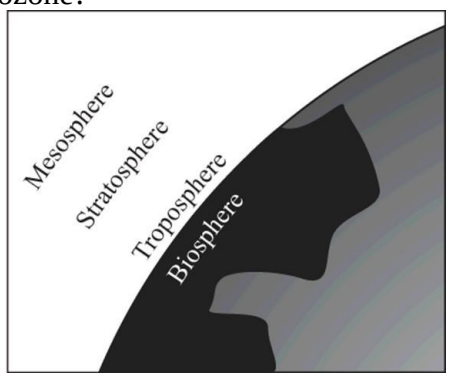
20. In the periodic table, which elements typically have similar properties?

A. those in the same rows
B. those related diagonally
C. those in the same columns
D. those on opposite sides

Groups are those with similar properties.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: The Periodic Table
Topic: Components of Matter

21. In the atmosphere over the Earth, where is the region with the highest concentration of ozone?



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

Remember that our protective layer of ozone is "up high".

Bloom's Level: 2. Understand
Section: 02.01
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

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.

Remember that the massive particles are in the nucleus while the electrons orbit around the outside.

Bloom's Level: 1. Remember
Section: 02.02
Subtopic: Atomic Structure
Topic: Components of Matter

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

Remember that the number of protons is the atomic number and that defines who the element is.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Atomic Number
Subtopic: Atomic Symbol
Topic: Study of Chemistry

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 Texas.
C. smaller than Rhode Island.
D. about the same size as California.

The ozone hole is quite large at its largest.

Bloom's Level: 1. Remember
Section: 02.01
Section: 02.08
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

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. valence electrons.
B. protons.
C. protons plus electrons.
D. protons plus neutrons.

Every element has its own unique number of protons and electrons, so it must be the outer electrons that make those in the same group similar.

Bloom's Level: 3. Apply
Section: 02.02
Subtopic: The Periodic Table
Topic: Study of Chemistry

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

Each element is defined by its number of protons, but isotopes have different masses.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Atomic Mass
Subtopic: Isotopes
Subtopic: The Periodic Table
Topic: Study of Chemistry

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

Two shared electrons form a bond.

Bloom's Level: 1. Remember
Section: 02.03
Subtopic: Covalent Bonding
Subtopic: Molecules
Topic: Chemical Bonding

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.

The protons define the element.

Bloom's Level: 1. Remember
Section: 02.02
Subtopic: Atomic Number
Topic: Study of Chemistry

29. The periodicity of the properties of elements is chiefly due to

A. the numbers of electrons in the atoms of the elements.
B. the distribution of electrons in the atoms of the elements.
C. the numbers of neutrons and electrons in the atoms of the elements.
D. both the numbers of electrons in the atoms of the elements and the distribution of electrons in the atoms of the elements.

Chemistry is about the electron and what they are doing.

Bloom's Level: 3. Apply
Section: 02.02
Subtopic: Atomic Structure
Subtopic: The Periodic Table
Subtopic: Valence Electrons

30. How many protons, neutrons, and electrons are there in the neutral atom of $^{13}_{6}C$?

	# 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

Remember that the mass is protons plus neutrons while protons must equal electrons for a neutral atom.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Atomic Mass
Subtopic: Atomic Number
Subtopic: Atomic Symbol
Subtopic: Elements
Subtopic: Isotopes
Topic: Study of Chemistry

31. Increasing wavelength of light goes in this order:

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

See Fig 2.7 for info on the wavelength of different forms of electromagnetic radiation.

Bloom's Level: 2. Understand
Section: 02.04
Subtopic: Types of EM Radiation
Topic: Electromagnetic Radiation

32. 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.

See fig 2.7 for information on the relationship between wavelengths and everyday items.

Bloom's Level: 2. Understand
Section: 02.04
Subtopic: Types of EM Radiation
Topic: Electromagnetic Radiation

33. Which is one of the Lewis dot structures for ozone?

A. :Ö:Ö:Ö:

B. :Ö::Ö::Ö:

C. :Ö::Ö:Ö:

D. Ö::Ö:Ö:

The total number of electrons that must be used is 18 while each atom needs an octet around it.

Bloom's Level: 2. Understand
Section: 02.03
Subtopic: Lewis Dot Symbols
Topic: Chemical Bonding

34. 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.

Remember that it is the Antarctic spring that leads to ozone destruction

Bloom's Level: 2. Understand
Section: 02.06
Subtopic: Atmospheric Chemistry
Topic: Chemical Reactions
Topic: Environmental Chemistry

35. 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.

Remember that electrons are not included in the total mass of an atom.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Atomic Mass
Subtopic: Isotopes
Subtopic: Mass Number
Topic: Components of Matter
Topic: Study of Chemistry

36. It is the _____ electrons that account for many of the chemical and physical properties of elements.

A. innermost
B. intermediate
C. outermost
D. transitional

These are the valence electrons and those must be on the outside.

Bloom's Level: 2. Understand
Section: 02.02
Section: 02.03
Subtopic: Elements
Subtopic: The Periodic Table
Subtopic: Valence Electrons
Topic: Study of Chemistry

37. 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.

Two electrons make one bond

Bloom's Level: 1. Remember
Section: 02.03
Subtopic: Covalent Bonding
Topic: Study of Chemistry

38. Light behaves like

A. a particle.
B. a wave.
C. both a particle and a wave.
D. neither a particle nor a wave.

Remember wave/particle duality

Bloom's Level: 2. Understand
Section: 02.05
Subtopic: Quanta
Topic: Electromagnetic Radiation

39. The "ozone layer" is found

A. only around the equator.
B. in the troposphere.
C. in the stratosphere.
D. in the mesosphere.

Good ozone is found high in the atmosphere

Bloom's Level: 1. Remember
Section: 02.01
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

40. 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.

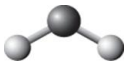
Think about how many waves instead of the size of the waves

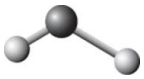
Bloom's Level: 2. Understand
Section: 02.04
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

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

A. 

B. 

C. 

D. 

Water has two equal bonds and has two lone pairs of electrons on the central oxygen

Bloom's Level: 2. Understand
Section: 02.03
Subtopic: Covalent Bonding
Topic: Chemical Bonding

42. 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

This cycle is about the interaction of oxygen and UV only.

Bloom's Level: 3. Apply
Section: 02.06
Subtopic: Atmospheric Chemistry
Topic: Chemical Reactions
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

43. Free radicals are

A. highly reactive chemical species.
B. species with unpaired electrons.
C. species such as H• and •OH.
D. All of these correctly describe free radicals.

Look at the other answers as well

Bloom's Level: 1. Remember
Section: 02.08
Subtopic: Atomic Symbol
Topic: Study of Chemistry

44. You wear sunscreen, but not sunblock, on your skin in order for the sunscreen to _____, thereby protecting your skin from some of the sun's radiation.

A. only transmit UV-A and UV-B radiation
B. only reflect visible radiation and UV-B radiation
C. both reflect and absorb UV-A and UV-B radiation
D. only absorb UV-A and UV-B radiation

See page 84

Bloom's Level: 2. Understand
Section: 02.07
Subtopic: Types of EM Radiation
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

45. 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.

Think about the complex process that leads to ozone destruction.

Bloom's Level: 2. Understand
Section: 02.09
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

46. 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.

There are more biological effects.

Bloom's Level: 2. Understand
Section: 02.01
Section: 02.06
Subtopic: Atmospheric Chemistry
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

47. 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.

Isotopes have the same number of protons and electrons

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Isotopes
Topic: Components of Matter

48. 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.

The valence electrons are those doing the business.

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Valence Electrons
Topic: Components of Matter

49. 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.

Look for more successes of this agreement.

Bloom's Level: 2. Understand
Section: 02.10
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

50. Halons differ from CFCs in that the atoms of _____ replace some _____ atoms.

A. iodine; chlorine
B. hydrogen; chlorine
C. bromine; chlorine
D. silicon; carbon

There is another halogen that is similar to chloride, but not as large as iodine

Bloom's Level: 1. Remember
Section: 02.10
Subtopic: Atmospheric Chemistry
Subtopic: Chemical Formulas
Topic: Environmental Chemistry

51. Which choice includes only polyatomic substances?

Box **I**	Ar, Na, and Fe
Box **II**	H_2O, CCl_2F_2, and CO_2
Box **III**	NH_3, CH_4, and SO_2
Box **IV**	P_4, S_8, and O_2

A. boxes I and II only
B. boxes I and IV only
C. boxes II and III only
D. boxes II, III, and IV only

Polyatomic means multiple atoms

Bloom's Level: 2. Understand
Section: 02.02
Subtopic: Chemical Formulas
Subtopic: Elements
Subtopic: Molecules
Topic: Study of Chemistry

52. Yellow light has a wavelength of 580 nm. What is the frequency of this light?

A. $2.39 \times 10^{-19}\ s^{-1}$
B. $1.80 \times 10^{-7}\ s^{-1}$
C. $5.17 \times 10^{5}\ s^{-1}$
D. $5.17 \times 10^{14}\ s^{-1}$

$\lambda \times \nu = c$ remember that wavelength is in meters and c = 3.0 x 10^8 m/s

Bloom's Level: 3. Apply
Section: 02.04
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

53. 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

bad media remember that wavelength is in meters and c = 3.0 x 10^8 m/s

Bloom's Level: 3. Apply
Section: 02.04
Subtopic: Quanta
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

54. 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

$E = h\nu$ where h = 6.626 x 10^{-34} Js

Bloom's Level: 3. Apply
Section: 02.05
Subtopic: Quanta
Topic: Electromagnetic Radiation

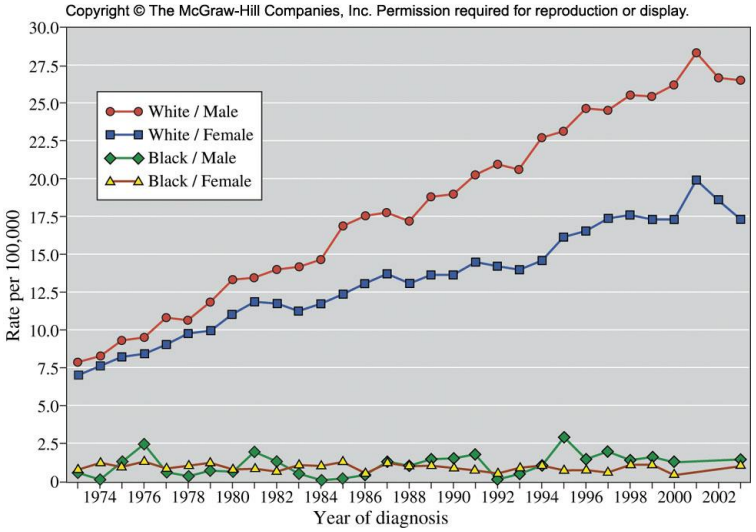
55. Which region of the ultraviolet spectrum is absorbed least by the atmosphere?

A. UV-A
B. UV-B
C. UV-C
D. They are all absorbed approximately equally.

The more energetic wavelengths are absorbed by oxygen gas and ozone molecules.

Bloom's Level: 2. Understand
Section: 02.06
Subtopic: Atmospheric Chemistry
Subtopic: Types of EM Radiation
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

56. 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%.

Percent is now divided by then times 100%

Bloom's Level: 2. Understand
Section: 02.04
Section: 02.10
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

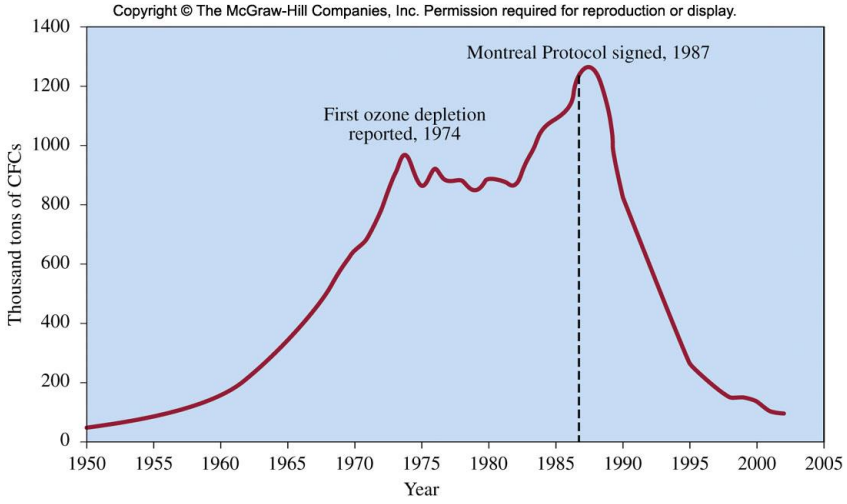
57. In the Chapman cycle, ozone formation depends upon a sufficient concentration of oxygen atoms. Which step in the Chapman cycle produces oxygen atoms?

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

See fig 2.10 for a visual representation of the Chapman cycle.

Bloom's Level: 2. Understand
Section: 02.06
Section: 02.08
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

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



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

Take the amount now divided by the amount then times 100%

Bloom's Level: 2. Understand
Section: 02.09
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

59. 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

Remember which of the halogens interacts to destroy ozone

Bloom's Level: 2. Understand
Section: 02.09
Section: 02.10
Subtopic: Atmospheric Chemistry
Topic: Chemical Reactions
Topic: Electromagnetic Radiation
Topic: Environmental Chemistry

60. 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.

It is the stable compounds of chlorine that caused the ozone hole in the first place.

Bloom's Level: 2. Understand
Section: 02.11
Subtopic: Atmospheric Chemistry
Subtopic: Chemical Formulas
Topic: Environmental Chemistry

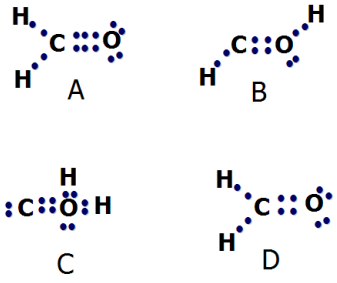
61. HCFCs are a temporary solution to the problem of ozone depletion and will be replaced over the next 20 years by which class of compounds?

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

Read section 2.11

Bloom's Level: 2. Understand
Section: 02.11
Subtopic: Chemical Formulas
Subtopic: Nomenclature
Topic: Environmental Chemistry

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



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

Only 12 valence electrons are distributed around the atoms. You must use them all.

Section: 02.03
Subtopic: Covalent Bonding
Subtopic: Lewis Dot Symbols
Topic: Chemical Bonding

63. 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.

Remember that chlorine destroys ozone

Bloom's Level: 2. Understand
Section: 02.11
Subtopic: Chemical Formulas
Topic: Chemical Bonding
Topic: Environmental Chemistry

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

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

Bloom's Level: 1. Remember
Section: 02.10
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

65. 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

Remember that the mass is protons plus neutrons while protons must equal electrons for a neutral atom.

Bloom's Level: 2. Understand
Subtopic: Atomic Mass
Subtopic: Elements
Subtopic: Mass Number
Topic: Components of Matter

66. 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

Remember that multiple bonds are shorter and stronger than their single counterparts.

Bloom's Level: 3. Apply
Section: 02.03
Section: 02.04
Section: 02.05
Subtopic: Covalent Bonding
Topic: Chemical Bonding
Topic: Electromagnetic Radiation

67. 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

Bloom's Level: 2. Understand
Section: 02.11
Subtopic: Atmospheric Chemistry
Subtopic: Chemical Formulas
Topic: Components of Matter
Topic: Environmental Chemistry

68. 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.

Global warming potential must be considered

Bloom's Level: 1. Remember
Section: 02.10
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

69. In what year will all production and importation of HCFCs end in the United States?

A. 2012
B. 2020
C. 2030
D. 2015

Bloom's Level: 1. Remember
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

70. 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.

Remember that PSCs only form in the Antarctic and that is where the ozone hole exists

Bloom's Level: 3. Apply
Section: 02.08
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

71. 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.

Remember that PSCs only form in the Antarctic and that is where the ozone hole exists

Bloom's Level: 2. Understand
Section: 02.08
Section: 02.10
Subtopic: Atmospheric Chemistry
Topic: Environmental Chemistry

72. 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

See fig. 2.7

Bloom's Level: 2. Understand
Section: 02.04
Subtopic: Types of EM Radiation
Subtopic: Wavelength, Frequency
Topic: Electromagnetic Radiation

73. Which of the following is most biologically damaging type of radiation?

A. UV-A
B. UV-B
C. UV-C
D. Infrared

Remember that UV-C is the most energetic while UV-A is the least energetic

Bloom's Level: 1. Remember
Section: 02.04
Subtopic: Types of EM Radiation
Topic: Electromagnetic Radiation

74. 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.

Remember that higher numbers mean higher exposure with 10-11 being the most extreme.

Bloom's Level: 2. Understand
Section: 02.06
Topic: Electromagnetic Radiation

75. You wear sunblock, but not sunscreen, on your skin in order for the sunblock to _____, thereby protecting your skin from some of the sun's radiation.

A. only transmit UV-A and UV-B radiation
B. only reflect visible radiation and UV-B radiation
C. both reflect and absorb UV-A and UV-B radiation
D. only absorb UV-A and UV-B radiation

Sunblock blocks the sun's rays. UV radiation is from the sun

Bloom's Level: 3. Apply
Section: 02.07
Topic: Electromagnetic Radiation