

1.	In a natural setting, these are components of soil, rock, or ecosystems that reduce the negative impacts of acid rain:
a)	atmospheric inversion
b)	fugitive sources
c)	photochemical smog
d)	primary pollutants
e)	buffers
	Ans: e Difficulty: Easy Link to: A Closer Look 24.1

2.	General class of pollution that characterizes urban area with frequent, strong sunshine
a)	atmospheric inversion
b)	fugitive sources
c)	photochemical smog
d)	primary pollutants
e)	buffers
	Ans: c Difficulty: Easy Link to: 24.4, 24.6

3.	This class of pollution is produced only at certain times, such as when the wind is blowing
a)	atmospheric inversion
b)	fugitive sources
c)	photochemical smog
d)	primary pollutants
e)	buffers
	Ans: b Difficulty: Medium Link to: 24.2

4.	Atmospheric inversion conditions over urban areas pose a problem primarily because:
a)	the conditions are conducive to photochemical smog
b)	pollutants are trapped and concentrated
c)	the inhabitants can be cut off from oxygen
d)	many sensitive plants and animals freeze to death

e)	CFCs are concentrated and destroy protective ozone
	Ans: b Difficulty: Medium Link to: 26.6

5.	Sulfur dioxide emissions are caused by:
I.	burning coal
II.	automobile emissions
III.	photochemical break-down of ozone in the stratosphere
a)	I only
b)	II only
c)	III only
d)	I and II
e)	I, II, and III
	Ans: d Difficulty: Medium Link to: 24.4

6.	According to the textbook, the best way to reduce sulfurous smog is:
a)	scrubbers
b)	coal gasification
c)	conservation of fossil fuels
d)	fluidized-bed combustion
e)	improved education
	Ans: a Difficulty: Easy Link to: 24.9

7.	The processes associated with acid rain or acid rain deposition include all of the following except:
a)	emission of sulfur dioxide and nitrogen oxides into the atmosphere via factory and automobile exhausts
b)	oxidation and complex reactions involving sulfur dioxide and nitrogen oxides in the atmosphere
c)	a rise in pH levels in lakes and streams
d)	"dry" deposition of sulfur dioxide or nitrogen oxides on vegetation, soil, etc. can later react with moisture to produce acid

e)	chemical reaction with limestone that damages buildings and monuments
	Ans: c Difficulty: Easy Link to: A Closer Look 24.1

8.	Particulate pollutants introduced into the atmosphere may have which of the following effects?
I.	reflect incoming sunlight, lowering the temperature at the surface
II.	absorb incoming sunlight, raising the temperature in the atmosphere
III.	act as condensation nuclei, decreasing precipitation
a)	I only
b)	II only
c)	III only
d)	I and II
e)	I, II, and III
	Ans: a Difficulty: Medium Link to: 24.4

9.	Nitrogen oxides (NO <sub>x</sub> ) are:
a)	a yellow-brown gas that contributes to photochemical smog
b)	a colorless and odorless gas that binds to hemoglobin in blood
c)	a colorless and odorless gas that damages the lungs
d)	a gas with a "rotten egg" odor that is highly toxic and corrosive
e)	a reactive gas produced, in part, by photochemical reaction of sunlight with various air pollutants
	Ans: a Difficulty: Medium Link to: 24.4

10.	Ozone is of great benefit in the stratosphere but of great harm to humans in the lower troposphere. Which of the following is not an effect on people?
a)	strong eye irritant
b)	aggravates asthma
c)	reduces the ability of the circulatory system to transport oxygen
d)	injury to cells in the respiratory system

e)	coughing and chest discomfort
	Ans: c Difficulty: Medium Link to: 24.8

11.	What is meant by a fugitive pollution source?
a)	air pollutants picked up from open areas exposed to wind
b)	minimum mileage (MPG) requirements for new cars in the U.S.
c)	pollutants from one or more controllable sites
d)	maximum levels of carbon monoxide in the air of major cities
e)	a well defined area within which are several sources of air pollutants
	Ans: a Difficulty: Easy Link to: 24.2

12.	Tall smokestacks on power plants were designed to:
a)	allow exhaust to cool before entering the atmosphere
b)	disperse pollutants, so they wouldn't cause harmful effects in the immediate area
c)	trap sulfur emissions
d)	augment the chimney effect in the area around the plant
e)	inhibit the reactions that form sulfuric acid
	Ans: b Difficulty: Medium Link to: A Closer Look 24.1

13.	Which of the following is the least significant air pollutant (either primary or secondary) associated with driving cars and other vehicles?
a)	carbon monoxide
b)	nitrous oxides
c)	gaseous hydrocarbons
d)	ozone
e)	hydrogen fluoride
	Ans: e Difficulty: easy Link to: 24.4

14.	Sulfur dioxide is:	
a)	a yellow-brown gas that contributes to photochemical smog	
b)	a colorless and odorless gas that binds to hemoglobin in blood	
c)	a colorless and odorless gas that damages the lungs	
d)	a gas with a "rotten egg" odor that is highly toxic and corrosive	
e)	a reactive gas produced, in part, by photochemical reaction of sunlight with various air pollutants	
	Ans: c Difficulty: Medium Link to: 24.4	

15.	A pipe spilling industrial effluent into a river is an example of a(n):	
a)	point source	
b)	fugitive source	
c)	area source	
d)	mobile source	
e)	polytoxic source	
	Ans: a Difficulty: Easy Link to: 24.2	

16.	How is photochemical smog produced?	
a)	depletion of tropospheric ozone + SO <sub>x</sub>	
b)	petroleum production in urban areas	
c)	incineration of toxic waste	
d)	solar radiation + NO <sub>x</sub> + organic compounds	
e)	burning of coal in urban areas + SO <sub>x</sub>	
	Ans: d Difficulty: Medium Link to: 24.6	

17.	During a 15-minute time period, a marathon runner will take in as much sulfur dioxide pollution from the as a person at rest will inhale in	
a)	one hour	
b)	two hours	
c)	three hours	
d)	four hours	
e)	five hours	

	<p>Ans: d          Difficulty: Medium          Link to: Case Study</p>
--	--------------------------------------------------------------------------------

18.	The pH of natural rainfall is _____; the pH of acid rain is _____.
a)	6-8; greater than 9
b)	5-6; less than 4.5
c)	6-8; less than 1.5
d)	5-6; less than 1.5
e)	4-5; greater than 7
	<p>Ans: b          Difficulty: Easy          Link to: A Closer Look 24.1</p>

19.	Secondary pollutants differ from primary pollutants in that they are not:
a)	as dangerous as primary pollutants
b)	emitted directly into the air as are primary pollutants
c)	eliminated from the atmosphere as easily as are primary pollutants
d)	as abundant as primary pollutants
e)	natural components of the atmosphere
	<p>Ans: b          Difficulty: Medium          Link to: 24.4</p>

20.	Hydrogen sulfide (H <sub>2</sub> S) is:
a)	a yellow-brown gas that contributes to photochemical smog
b)	a colorless and odorless gas that binds to hemoglobin in blood
c)	a colorless and odorless gas that damages the lungs
d)	a gas with a "rotten egg" odor that is highly toxic and corrosive
e)	a reactive gas produced, in part, by photochemical reaction of sunlight with various air pollutants
	<p>Ans: d          Difficulty: Easy          Link to: 24.4</p>

21.	Ozone (O <sub>3</sub> ) is:
a)	a yellow-brown gas that contributes to photochemical smog

b)	a colorless and odorless gas that binds to hemoglobin in blood
c)	a colorless and odorless gas that damages the lungs
d)	a gas with a "rotten egg" odor that is highly toxic and corrosive
e)	a reactive gas produced, in part, by photochemical reaction of sunlight with various air pollutants

Ans: e  
 Difficulty: Easy  
 Link to: 24.4

22.	Which of the following are the most significant fine particulate pollutants?
a)	fog
b)	fly ash
c)	sea salt particles
d)	sulfates and nitrates
e)	suspended asbestos
	Ans: d Difficulty: Easy Link to: 24.4

23.	According to the textbook, "Arctic haze" mainly comes from:
a)	North America
b)	the world's oceans
c)	the Arctic
d)	extraterrestrial sources
e)	Western Europe
	Ans: e Difficulty: Easy Link to: 25.5

24.	Which of the following is a secondary pollutant and a major component of photochemical smog:
a)	sulfur dioxide
b)	ozone
c)	particulate matter
d)	asbestos
e)	gaseous hydrocarbons

	<p>Ans: b</p> <p>Difficulty: Easy</p> <p>Link to: 24.4</p>
--	------------------------------------------------------------

25.	Which of the following gases in the atmosphere increase the acidity of rainfall?
I.	CO <sub>2</sub>
II.	SO <sub>2</sub>
III.	NO <sub>2</sub>

a)	I only
b)	II only
c)	III only
d)	II and III
e)	I, II, and III

	<p>Ans: e</p> <p>Difficulty: Easy</p> <p>Link to: A Closer Look 24.1</p>
--	--------------------------------------------------------------------------

26.	Which of the following is a true statement about particulate matter in the atmosphere?
-----	----------------------------------------------------------------------------------------

a)	it is introduced to the atmosphere only by human activity
b)	it is primarily an effect of automobile emissions and photochemical reactions
c)	it amplifies incoming solar radiation
d)	its effects are limited to local atmospheric inversion episodes
e)	particles function as condensation nuclei, increasing the amount of precipitation

	<p>Ans: e</p> <p>Difficulty: Medium</p> <p>Link to: 24.4</p>
--	--------------------------------------------------------------

27.	Acid surges are associated with accumulation of "_____ deposition".
-----	---------------------------------------------------------------------

a)	wet
b)	moist
c)	dry
d)	arid
e)	acid fog



	<p>Ans: c          Difficulty: Easy          Link to: A Closer Look 24.1</p>
--	--------------------------------------------------------------------------------------

28.	Carbon monoxide is particularly dangerous to humans because:
a)	it damages the nervous system
b)	low concentrations affect healthy and sickly people equally
c)	its deleterious effects increase with decreasing altitude
d)	it prevents O <sub>2</sub> from reaching vital tissues
e)	all of these
	<p>Ans: d          Difficulty: Medium          Link to: 24.4</p>

29.	Which of the following would tend to buffer (reduce) the effects of acid rain?
a)	granite underlying a lake
b)	thin soils
c)	addition of methyl mercury to lakes
d)	calcium-carbonate-rich soils
e)	replacement of tall smokestacks with short stacks at nearby sulfur point sources
	<p>Ans: d          Difficulty: Easy          Link to: A Closer Look 24.1</p>

30.	In the lower atmosphere, ozone is produced by:
a)	photochemical reactions
b)	emissions from coal plants
c)	ultraviolet-B radiation
d)	oxidation of CO <sub>2</sub>
e)	reduction of natural hydrocarbons
	<p>Ans: a          Difficulty: Easy          Link to: 24.4</p>

31.	Which of the following is not a primary pollutant from the burning of fossil fuels?
a)	chlorophyll

b)	particulate matter
c)	carbon monoxide
d)	hydrocarbons
e)	nitrogen oxides
	Ans: a Difficulty: Easy Link to: 24.4

32.	Which of the following was an important factor in producing air pollution during the 2008 Summer Olympics in Beijing, China?
a)	coal-fired electrical power plants
b)	air stagnation caused by hills surrounding the city
c)	southerly winds
d)	coal used to heat homes in the city
e)	all of these were important factors
	Ans: e Difficulty: Easy Link to: Case Study

33.	Which compound often neutralizes the acid in acid rain that falls in lakes?
a)	sulfur dioxide
b)	bicarbonate ion
c)	nitrous oxide
d)	ozone
e)	carbon dioxide
	Ans: b Difficulty: Medium Link to: A Closer Look, 24.1

34.	Las Vegas has some of the most polluted air in the southwestern United States. Which of the following pollutants is the primary cause of the polluted air?
a)	photochemical smog
b)	ozone
c)	acid rain
d)	SO <sub>2</sub>
e)	particulate matter

	<p>Ans: e          Difficulty: Medium          Link to: 24.5</p>
--	--------------------------------------------------------------------------

35.	Which pollutant is most commonly associated with coal-fired electrical generation?
a)	CO
b)	NO <sub>x</sub>
c)	O <sub>3</sub>
d)	SO <sub>2</sub>
e)	HC
	<p>Ans: d          Difficulty: Easy          Link to: 24.4</p>

36.	Carbon monoxide (CO) is:
a)	a yellow-brown gas that contributes to photochemical smog
b)	a colorless and odorless gas that binds to hemoglobin in blood
c)	a colorless and odorless gas that damages the lungs
d)	a gas with a "rotten egg" odor that is highly toxic and corrosive
e)	a reactive gas produced, in part, by photochemical reaction of sunlight with various air pollutants
	<p>Ans: b          Difficulty: Easy          Link to: 24.4</p>

37.	In the figure below, pollution conditions are worst when _____; and at locations where _____.
a)	wind is slow and mixing height is high; distance from the coast to the mountains is large
b)	wind is slow and mixing height is low; distance from the coast to the mountains is large
c)	wind is fast and mixing height is high; distance from the coast to the mountains is small
d)	wind is fast and mixing height is low; distance from the coast to the mountains is large
e)	wind is slow and mixing height is high; distance from the coast to the mountains is small

	<p>Ans: e          Difficulty: Medium          Link to: 24.6</p>
--	--------------------------------------------------------------------------

38.	In the city illustrated in the figure below, the pollution emission rate is 20 kg per m <sup>2</sup> per second, the wind is blowing onshore at 10 m per second, and the mixing height is 1000 m. Based on this information, what would the pollution concentration be at a point 5 km inland of the coast?
-----	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

a)	1 kg per m <sup>2</sup>
b)	10 kg per m <sup>3</sup>
c)	10 kg
d)	0.001 kg per m <sup>3</sup>
e)	100 kg per m <sup>2</sup>

	<p>Ans: b          Difficulty: Difficult          Link to: 24.6</p>
--	-----------------------------------------------------------------------------

39.	The development of photochemical smog is directly related to
-----	--------------------------------------------------------------

a)	automobile use
b)	burning of coal in power plants
c)	burning of oil in power plants
d)	homes using electricity
e)	all of these

	<p>Ans: e          Difficulty: Easy          Link to: 24.5</p>
--	------------------------------------------------------------------------

40.	Match the following pH value with the substances in which they may have been measured.		
	pH=1	_____	a) distilled water
	pH=4	_____	b) strong acid
	pH=7	_____	c) strong base
	pH=13	_____	d) acid precipitation

Ans:	(from top to bottom): b, d, a, c
------	----------------------------------

	<p>Difficulty: Easy          Link to: A Closer Look 24.1</p>
--	------------------------------------------------------------------

41.	Match each of the major air pollutants listed on the left with its definition or one of its characteristics listed on the right:		
	Sulfur Dioxide	_____	a. toxic gas with a rotten-egg odor
	Nitrogen Oxides	_____	b. ozone is the main example of this
	Carbon Monoxide	_____	c. combines with water to form sulfuric acid
	Oxidants	_____	d. toxic gas released in aluminum production
	Hydrocarbons	_____	e. emitted by automobiles as well as trees
	Hydrogen Sulfide	_____	f. toxic gas that is colorless and odorless
	Hydrogen Fluoride	_____	g. series of chemicals, including gas and particulate forms, emitted by burning fossil fuels
Ans:	c, f, g, b, e, a, d		
	Difficulty: Medium Link to: 24.4.		

42.	List three different types of damage done by acid rain.		
Ans:	leaching of nutrients in soil mobilization of toxic elements death of trees eutrophication of lakes damage to buildings and monuments		
	Difficulty: Medium Link to: A Closer Look, 24.1		

43.	Name the two principal pollutants that contribute to acid rain, and the main source of each.		
Ans:	SO <sub>2</sub> – fossil fuel combustion NO <sub>x</sub> – automobiles		
	Difficulty: Easy Link to: A Closer Look, 24.1		

44.	Explain under what circumstances an atmospheric inversion occurs and how it can lead to pollution events.
Ans:	when warmer air is found above cooler air. where there is restricted circulation this inversion layer can lead to pollution events in the lower atmosphere
	Difficulty: Medium Link to: 26.6

45.	List two natural conditions that help buffer (reduce) the effects of acid rain.
Ans:	limestone substrate thick, calcium carbonate-rich soils
	Difficulty: Easy Link to: A Closer Look, 24.1

46.	There are three main types of acid deposition events. One is precipitation (rain, snow, and ice). List the other two.
Ans:	dry deposition and fog
	Difficulty: Easy Link to: A Closer Look, 24.1

47.	Under normal circumstances, UV penetration is greater nearer the equator than at the poles, however, Antarctica sometimes registers a higher reading than San Diego. How do you explain this?
Ans:	Ozone depletion (the ozone hole) over Antarctica allows greater amounts of UV radiation to reach the surface than would otherwise happen.
	Difficulty: Medium Link to: A Closer Look, 24.2

48.	Give an example of each of the following pollution sources: point source, fugitive source, area source.
Ans:	e.g., smoke stack, freshly-plowed field, auto exhaust
	Difficulty: Medium Link to: 24.2

49.	Name two of the processes that lead to the accumulation and concentration of "Arctic haze".	
Ans:	the temperature contrast between the equator and the North pole seasonal high and low pressure systems in Eurasia and the North Atlantic once air reaches the arctic, it stratifies and concentrates there	
	Difficulty: Easy Link to: 24.2	

50.	Name the principal effect of acid rain on each of the following:	
	soils	
	trees	
	lakes	
	limestone monuments	
Ans:	soils – leaches out heavy metals and nutrients trees – direct damage lakes – kills fish limestone monuments – weathers limestone	
	Difficulty: Medium Link to: A Closer Look , 24.1	

51.	Explain the term "secondary pollutant" and give an example.	
Ans:	Ozone is a secondary pollutant which is created through reactions among primary pollutants, sunlight, and natural atmospheric gases.	
	Difficulty: Medium Link to: 24.4	

52.	Name the three major types of smog and list the principal cause of each.	
Ans:	photochemical smog – automobile exhaust sulfurous smog – coal or oil burning particulate smog – burning fossil fuels, blown dust	

	Difficulty: Medium Link to: 24.5
--	-------------------------------------

53.	Natural rainfall is slightly acidic. Explain why.
Ans:	Water in the atmosphere combines with CO <sub>2</sub> to form carbonic acid.
	Difficulty: Medium Link to: A Closer Look, 24.1

54.	Air pollutants are sometimes classified as either primary or secondary. Explain the difference and give an example of each.
Ans:	primary – emitted directly into the air, e.g. carbon dioxide secondary – transformed by sunlight, etc. from a preexisting chemical, e.g. NO <sub>x</sub>
	Difficulty: Medium Link to: 24.4