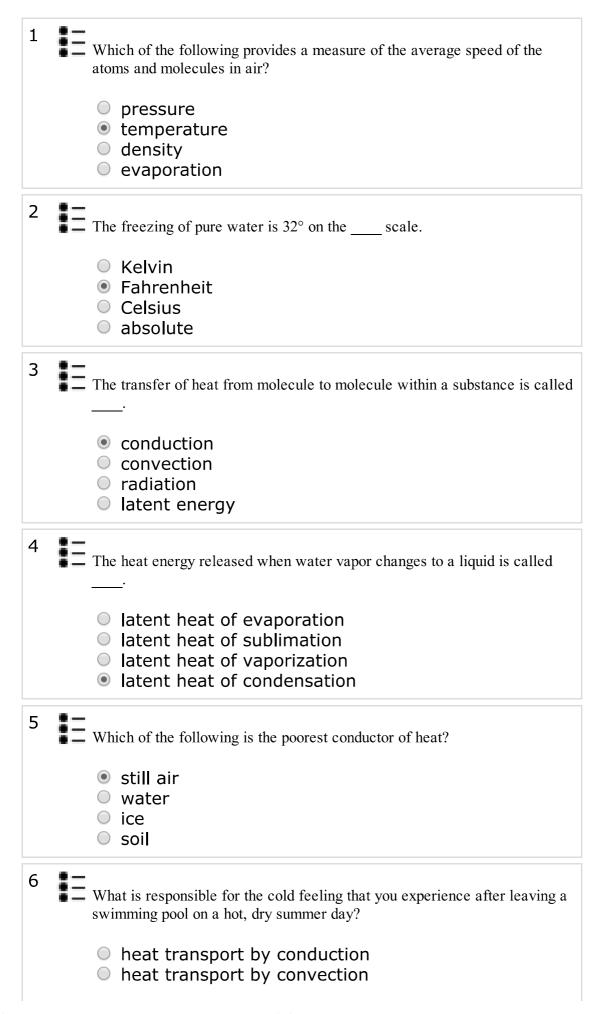
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Chapter 2 - Warming the Earth and the Atmosphere

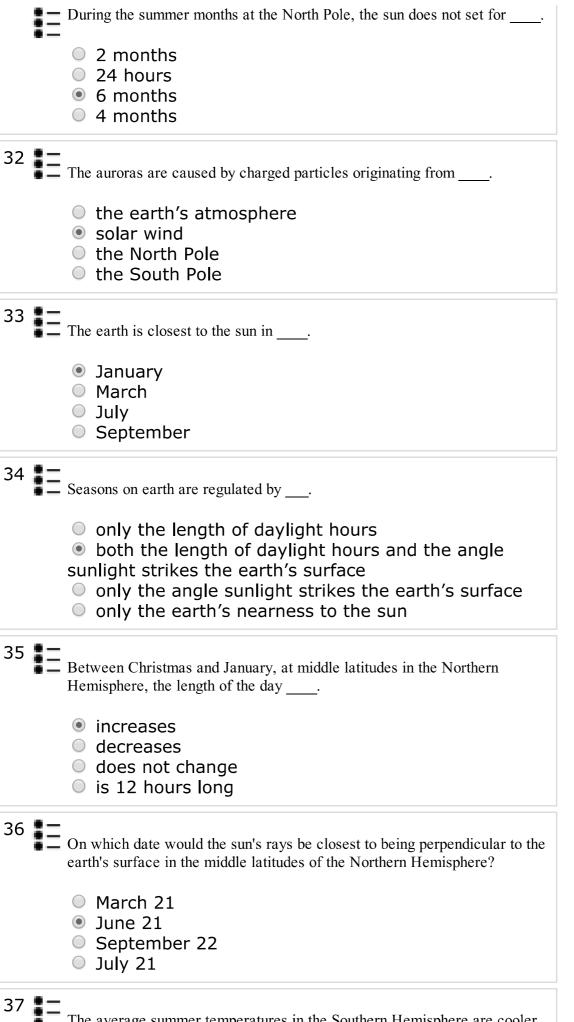


	heat transport by radiationheat transport by latent heat
7	The movement of smoke in the atmosphere from one area to another by wind is an example of
	advectionradiationconductionreflection
8	In the lower atmosphere, any air that rises will and cool.
	expandevaporatecompressvaporize
9	During atmospheric convection, rising air bubbles are called
	windvaporsthermalsclouds
10	A heat transfer process in the atmosphere that depends upon the movement of air is
	conductionreflectionconvectionradiation
11	Radiation is made of discrete packets of energy called
	thermalsconvective cellsphotonsmicrons
12	The wavelength of radiation is proportional to the energy carried per wave.
	directlynotslightlyinversely

13	Which region of the sun's electromagnetic spectrum is most responsible for human skin cancer?
	 infrared ultraviolet visible near infrared
	o fiedi ilifared
14	Energy transferred by electromagnetic waves is called
	magnetismconvectionconductionradiation
15	The proper order from shortest to longest wavelength is
	 ultraviolet, infrared, and visible infrared, visible, and ultraviolet ultraviolet, visible, and infrared visible, ultraviolet, and infrared
16	Electromagnetic radiation with wavelengths between 0.4 and 0.7 micrometers is called
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The wavelengths of radiation that an object emits depend primarily on the object's
temperaturephotonsdensityreflective surfaces
As the temperature of an object, the intensity of the radiation emitted by the object
 increases; increases increases; decreases decreases; stays the same decreases; increases
21
 oxygen and ozone absorb ultraviolet radiation nitrogen and oxygen transmit visible radiation cloud formation releases latent heat energy carbon dioxide and water vapor absorb infrared radiation
Without the atmospheric greenhouse effect, the average surface temperature of the earth would be
 higher than at present lower than at present the same as it is now much more variable than it is now
23 E An object at radiative equilibrium temperature is behaving as a
selective absorberblackbodylight reflectorgreenhouse gas
24 The earth emits infrared radiation
only at nightonly during the dayat variable timescontinuously
25 Which of the following has a higher albedo than thin clouds?

tne moonsnow
o ice
water
26 * =
Although water vapor accounts for about 60% of the atmospheric greenhouse effect, it is the increase of in the atmosphere that appears
to be the main cause of global warming.
carbon monoxide
ozonecarbon dioxide
argon
27 ≛ =
The albedo of the earth's surface is only about 4%, yet the combined albedo of the earth and the atmosphere is about 30%. Which set of conditions
below best explains why this is so?
high albedo of clouds; low albedo of water
high albedo of clouds; high albedo of water
low albedo of clouds; low albedo of waterlow albedo of clouds; high albedo of water
Town dipode or elegacy mg. dipode or mate.
The earth's surface receives about twice as much energy from the
atmosphere than from the sun as a result of
the release of latent heat during condensation
 conduction of heat upward from the surface
convectionabsorbed infrared energy radiated back to earth
o direct absorption of sunlight by the atmosphere
29 ! _
Which process accounts for the sky's blue color?
 light reflection
light scattering
albedothermal convection
An object that radiates more energy than it absorbs will
become colder
become warmer maintain the same temperature
maintain the same temperaturereach radiative equilibrium



The average summer temperatures in the Southern Hemisphere are cooler than the average summer temperatures in the Northern Hemisphere because

		 the earth is closer to the sun in January the earth is farther from the sun in July over 80% of the Southern Hemisphere is covered with water the sun's energy is less intense in the Southern Hemisphere
38	=	In the middle latitudes of the Northern Hemisphere, the day with the shortest number of daylight hours occurs on
		June 21December 21September 22January 1
39	: =	When it is January and winter in the Northern Hemisphere, it is in the Southern Hemisphere.
		 January and summer January and winter July and winter July and summer
40		For maximum winter warmth, in the Northern Hemisphere, large windows in a house should face
		northsoutheastwest
41	• •	The formation of ice releases heat and warms the surroundings.
		TrueFalse
42	••	Microwave radiation has a longer wavelength and carries more energy per wave than visible light. True
		False

••	When an object emits and absorbs energy at equal rates, its temperature increases.
	TrueFalse
44	The Southern Hemisphere has warmer summers and colder winters than the Northern Hemisphere.
	TrueFalse
45 😱	Airline routes are sometimes changed as a result of solar storms.
	TrueFalse
46	Instructions: Choose one answer from each pair of selections.
	If you could somehow see the random motions of atoms and molecules in air, would they all be moving at the SAME or at DIFFERENT speeds?
	Answer:
	DIFFERENT
47	Instructions: Choose one answer from each pair of selections.
	Air is a GOOD POOR conductor of heat.
	Answer:
	POOR
48	Instructions: Choose one answer from each pair of selections.
	The longest wavelengths of visible light correspond to the color RED VIOLET.

		Answer:
		RED
49	==	Instructions: Choose one answer from each pair of selections.
		At a UV index of 10, a person should take EXTRA MODERATE precautions when exposed to sunlight.
		Answer:
		EXTRA
50	==	Instructions: Choose one answer from each pair of selections.
		Overcast skies usually result in cooler daytime temperatures because clouds are good REFLECTORS ABSORBERS of sunlight.
		Answer:
		REFLECTORS
51		Instructions: Choose one answer from each pair of selections.
		The earth's atmosphere SELECTIVELY CONTINUOUSLY absorbs radiation.
		Answer:
		SELECTIVELY
52	==	Instructions: Choose one answer from each pair of selections.
		Which is a better reflector of solar energy, WATER or ICE?
		Answer:

T	1	7	С	
			н	

53



Instructions: Choose one answer from each pair of selections.

To see the aurora australis, you have to travel to the NORTHERN | SOUTHERN Hemisphere.

Answer:

SOUTHERN

54



Instructions: Choose one answer from each pair of selections.

Compared to Phoenix (30°N latitude), Minneapolis (45°N) will have shorter days in the winter and LONGER | SHORTER days in the summer.

Answer:

LONGER

55



Instructions: Choose one answer from each pair of selections.

In the middle latitudes of the Northern Hemisphere, the sun's position can affect vegetation. Would you expect a SOUTH- or a NORTH-facing hill to receive more sunlight during a year?

Answer:

SOUTH

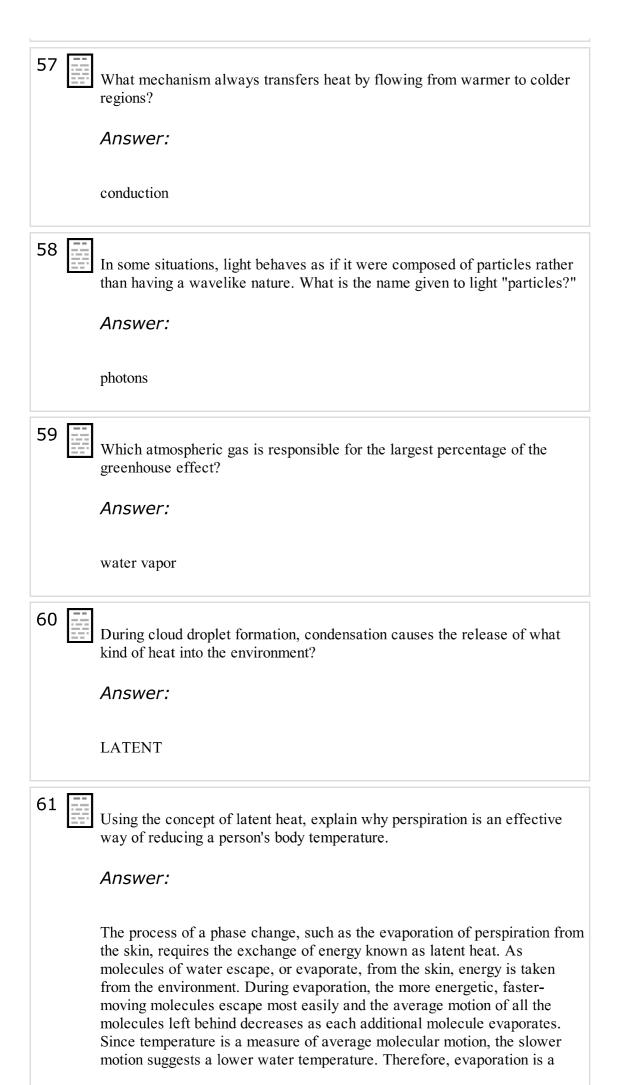
56



What provides a measure of the average speed or kinetic energy of the atoms and molecules in air?

Answer:

temperature



cooling process because the energy needed to change the water's phase from liquid to a gas is taken from the environment.

62



Does the expansion of air cause its temperature to increase or decrease? Why?

Answer:

Expansion decreases the temperature of air. As air rises in the atmosphere the surrounding air pressure decreases allowing for the air to expand. Because there is no other energy source, the air molecules use their own energy to spread out. This energy loss causes a reduction in molecular speed and, therefore, air temperature as well.

63



In the discussion of the earth's annual energy balance, we saw that the earth absorbed approximately 51 units of solar energy but emitted 117 units of infrared energy. What prevents the earth from getting colder and colder?

Answer:

Only a fraction of the emitted energy passes through into space. The majority of the energy is absorbed in the atmosphere mainly by greenhouse gases (primarily water vapor and carbon dioxide) and clouds. Much of this absorbed energy is then radiated back to earth, producing the atmospheric greenhouse effect and, therefore, preventing the cooling of the earth.

64



If the amount of snow and ice in the polar regions of the earth were to decline due to global warming, how would you expect this to affect the radiation budget of the earth?

Answer:

The percent of radiation reflected from a given surface is the albedo. Snow has one of the highest albedo percentages, in that up to 95% of sunlight may be reflected from the snow surface. If total snow cover on earth is reduced, the energy that would have been reflected becomes absorbed instead. Increased polar snow and ice melt will result in higher sea levels, which coupled with rising ocean temperatures will cause an increase in evaporation rates that will add more water vapor (a greenhouse gas) to the atmosphere and, subsequently, increase the amount of radiation returned to earth.

65



Explain why sunrises and sunsets typically have colors of red, orange, and yellow.

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Solar radiation entering the earth's atmosphere is scattered as it strikes air molecules and dust particles. Because air molecules are much smaller than the wavelengths of visible light, they more effectively scatter the shorter (blue) wavelengths than the longer (red) wavelengths. At sunrise and sunset, the sun is (typically) located on the horizon and sunlight must travel a longer distance through a thicker portion of the atmosphere. As sunlight travels along this path, the shorter wavelengths of visible light are more effectively scattered by the atmospheric air particles and the longer wavelengths of red, orange, and yellow are allowed to pass through, thereby creating the image of a red/orange sun.