Heat can be transferred by

A. conduction.
B. convection.
C. radiation.
D. All of the above.
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B. convection.
C. radiation.
D. All of the above.
Thermal conduction has much to do with

A. electrons.
B. protons.
C. neutrons.
D. ions.
Thermal conduction has much to do with

A. **electrons.**
B. **protons.**
C. **neutrons.**
D. **ions.**

*Explanation:*
Electrons are a chief carrier of thermal energy, especially in metals.
If you hold one end of a metal bar against a piece of ice, the end in your hand will soon become cold. Does cold flow from the ice to your hand?

A. Yes.
B. In some cases, yes.
C. No.
D. In some cases, no.
If you hold one end of a metal bar against a piece of ice, the end in your hand will soon become cold. Does cold flow from the ice to your hand?

A. Yes.
B. In some cases, yes.
C. No.
D. In some cases, no.

**Explanation:**
Cold does not flow from the ice to your hand. Heat flows from your hand to the ice. The metal is cold to your touch, because you are transferring heat to the metal.
A firewalker walking barefoot on hot wooden coals depends on wood’s

A. poor conduction.
B. good conduction.
C. high specific heat capacity.
D. convection.
A firewalker walking barefoot on hot wooden coals depends on wood’s

A. poor conduction.
B. good conduction.
C. high specific heat capacity.
D. convection.
Thermal convection has much to do with

A. radiant energy.
B. fluids.
C. insulators.
D. All of the above.
Thermal convection has much to do with

A. radiant energy.
B. fluids.
C. insulators.
D. All of the above.
When air rapidly expands, it generally

A. warms.
B. cools.
C. convects away.
D. compresses later.
When air rapidly expands, it generally

A. warms.
B. cools.
C. convects away.
D. compresses later.

*Comment:*
Blow on your hand with lips puckered so your breath expands. Isn’t your hand cooled? Conversely, when air is compressed it generally warms.
Which body emits radiant energy into space?

A. Sun.
B. Earth.
C. Both of the above.
D. None of the above.
Which body emits radiant energy into space?

A. Sun.
B. Earth.
C. Both of the above.
D. None of the above.
A high-temperature source radiates relatively

A. short wavelengths.
B. long wavelengths.
C. low frequencies of radiation.
D. None of the above.
A high-temperature source radiates relatively

A. short wavelengths.
B. long wavelengths.
C. low frequencies of radiation.
D. None of the above.

Explanation:
The relation \( \bar{f} \sim T \) tells us that high-temperature sources emit high-frequency waves. High-frequency waves have short wavelengths.
Which of these electromagnetic waves has the lowest frequency?

A. Infrared.
B. Visible.
C. Ultraviolet.
D. Gamma rays.
Which of these electromagnetic waves has the lowest frequency?

A. Infrared.
B. Visible.
C. Ultraviolet.
D. Gamma rays.

Explanation:
The relation $\tilde{f} \sim T$ tells us that low temperature sources emit low frequency waves. The lowest frequency waves in the list are infrared waves.
Compared with radiation from the Sun, terrestrial radiation has a lower

A. wavelength.
B. frequency.
C. Both of the above.
D. Neither of the above.
Compared with radiation from the Sun, terrestrial radiation has a lower

A. wavelength.
B. frequency.
C. Both of the above.
D. Neither of the above.

Explanation:
The relation $\tilde{f} \sim T$ tells us that high-temperature sources emit high-frequency waves. High-frequency waves from the Sun have short wavelengths. Terrestrial waves are longer.
The origin of much of the thermal energy in Earth’s interior is

A. radioactive decay.
B. high pressure.
C. low thermal conductivity of rock.
D. trapped radiant energy.
The origin of much of the thermal energy in Earth’s interior is

A. radioactive decay.
B. high pressure.
C. low thermal conductivity of rock.
D. trapped radiant energy.
A substance that absorbs energy well also

A. conducts well.
B. convects well.
C. radiates well.
D. None of the above.
A substance that absorbs energy well also

A. conducts well.
B. convects well.
C. **radiates well.**
D. None of the above.
A hot pizza placed in the snow is a net

A. absorber.
B. emitter.
C. Both of the above.
D. None of the above.
A hot pizza placed in the snow is a net

A. absorber.
B. emitter.
C. Both of the above.
D. None of the above.

*Comment:*
The same hot pizza placed in a hotter oven would be a net absorber.
Which is a more accurate statement?

A. A black object absorbs energy well.
B. An object that absorbs energy well is black.
C. Both say the same thing, so both are equivalent.
D. Both are untrue.
Which is a more accurate statement?

A. A black object absorbs energy well.
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Explanation:
This is a cause–effect type question. The color black doesn’t draw in and absorb energy. It’s the other way around—any object that does draw in and absorb energy will consequently appear black in color.
Will wrapping a fur coat around a thermometer normally make the temperature rise?

A. Yes.
B. No.
C. It depends on the temperature outside.
D. Not enough information given in the question.
Will wrapping a fur coat around a thermometer normally make the temperature rise?

A. Yes.
B. No.
C. It depends on the temperature outside.
D. Not enough information given in the question.

Explanation:
The fur coat and thermometer remain at the same temperature, assuming they’re the same temperature to begin with. One would have to be warmer than the other for a change in temperature.
Although warm air rises, why are mountaintops cold and snow covered, while the valleys below are relatively warm and green?

A. Warm air cools when rising.
B. There is a thick insulating blanket of air above valleys.
C. Both of the above.
D. None of the above.
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**Explanation:**
Earth’s atmosphere acts as a blanket, which for one important thing, keeps Earth from freezing at nighttime.
If a good absorber of radiant energy were a poor emitter, its temperature compared with its surroundings would be

A. lower.
B. higher.
C. unaffected.
D. None of the above.
If a good absorber of radiant energy were a poor emitter, its temperature compared with its surroundings would be

A. lower.
B. higher.
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Explanation:
If a good absorber were not also a good emitter, there would be a net absorption of radiant energy, and the temperature of a good absorber would remain higher than the temperature of the surroundings. Nature is not so!
If the atmosphere somehow became more transparent to infrared radiation, Earth’s temperature would tend to

A. increase.
B. decrease.
C. remain unchanged.
D. None of these.
If the atmosphere somehow became more transparent to infrared radiation, Earth’s temperature would tend to

A. increase.  
B. decrease.  
C. remain unchanged.  
D. None of these.

*Explanation:*
More transparency to terrestrial radiation would mean less of a greenhouse effect. So cooling, rather than the present warming, would occur.
When a liquid changes phase to a gas, it

A. absorbs energy.
B. emits energy.
C. neither absorbs nor emits energy.
D. becomes more conducting.
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C. neither absorbs nor emits energy.
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When water is brought to a boil, the boiling process tends to

A. resist a further change of phase.
B. heat the water.
C. cool the water.
D. radiate energy from the system.
When water is brought to a boil, the boiling process tends to

A. resist a further change of phase.
B. heat the water.
C. cool the water.
D. radiate energy from the system.
Newton’s law of cooling applies to objects

A. cooling.
B. warming.
C. Both of these.
D. None of the above.
Newton’s law of cooling applies to objects

A. cooling.
B. warming.
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D. None of the above.
A hot bowl of chili placed in the snow is a net

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C. Both of these.
D. Neither of these.
A hot bowl of chili placed in the snow is a net

A. absorber.
B. emitter.
C. Both of these.
D. Neither of these.

Comment:
And the same bowl of chili placed in a very hot oven would be a net absorber.
The origin of much of the thermal energy in Earth’s interior is

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B. low thermal conductivity of rock.
C. trapped radiant energy.
D. radioactive decay.
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Compared with radiation from the Sun, Earth’s radiation has a

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When air rapidly expands, its temperature normally

A. increases.
B. decreases.
C. remains unchanged.
D. is unaffected, but not always.
When air rapidly expands, its temperature normally

A. increases.
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C. remains unchanged.
D. is unaffected, but not always.
A soda pop can with a bit of water in it is put on a hot stove. Soon steam comes from its opening. When quickly inverted into a pan of water, the can is crushed by atmospheric pressure. Gas pressure inside the can is reduced by

A. a drop in temperature.
B. a great pressure difference between inside and outside.
C. adiabatic compression.
D. condensation of the steam inside.
A soda pop can with a bit of water in it is put on a hot stove. Soon steam comes from its opening. When quickly inverted into a pan of water, the can is crushed by atmospheric pressure. Gas pressure inside the can is reduced by

A. a drop in temperature.
B. a great pressure difference between inside and outside.
C. adiabatic compression.
D. condensation of the steam inside.
Place a dish of water on a table and let it sit for several hours. During this time,

A. water is evaporating from the dish.
B. water from the air is condensing in the dish.
C. Both are occurring.
D. None of the above.
Place a dish of water on a table and let it sit for several hours. During this time,

A. water is evaporating from the dish.
B. water from the air is condensing in the dish.
C. Both are occurring.
D. None of the above.

Explanation:
Both processes occur simultaneously. If one exceeds the other then a net evaporation or a net condensation results. If the rates are equal, the water level in the dish remains constant.
When testing for the hotness of a clothes iron, it is best to

A. hold your finger to it for a long time to be sure.
B. hold several fingers to the iron to really be sure.
C. wet your finger first and touch the iron briefly.
D. None of these.
When testing for the hotness of a clothes iron, it is best to

A. hold your finger to it for a long time to be sure.
B. hold several fingers to the iron to really be sure.
C. **wet your finger first and touch the iron briefly.**
D. None of these.

*Comment:*
If the iron is very hot, the heat that goes into vaporizing the moisture on your finger is heat that doesn’t burn you (as Mom likely taught you as a younger).
Your inventor friend comes up with a harmless and tasteless kind of salt that changes the boiling point of water. The usefulness of this salt in kitchens will be best if it

A. lowers the boiling point of water.
B. increases the boiling point of water.
C. Neither of these.
Your inventor friend comes up with a harmless and tasteless kind of salt that changes the boiling point of water. The usefulness of this salt in kitchens will be best if it

A. lowers the boiling point of water.
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