1. Which law governs the transfer of heat by the movement of hot molecules to cooler ones?

a) Fourier’s Law
b) Newton’s Law
c) Stefan-Boltzmann Law
d) Carnot’s Law

Answer: a) Fourier’s Law
Explanation: Fourier’s Law describes the conduction of heat through a medium due to a temperature gradient. It states that the rate of heat transfer is directly proportional to the temperature gradient and the area perpendicular to the direction of heat flow.

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2. What physical quantity does thermal conductivity represent?

a) Ability of a material to store heat
b) Rate of heat transfer through a material
c) Resistance of a material to heat flow
d) Ability of a material to generate heat

Answer: b) Rate of heat transfer through a material
Explanation: Thermal conductivity is a measure of how easily heat passes through a material. It represents the rate at which heat energy is transferred through a unit area of the material, per unit thickness, per unit temperature gradient.

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3. What is the primary mode of heat transfer that occurs in a vacuum?

a) Conduction
b) Convection
c) Radiation
d) Advection

Answer: c) Radiation
Explanation: Radiation is the transfer of heat energy through electromagnetic waves and does not require a medium for propagation. In a vacuum, where there is no medium for conduction or convection, heat transfer occurs solely through radiation.

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4. What property of a material affects its rate of heat conduction?

a) Density
b) Specific heat
c) Thermal conductivity
d) Thermal diffusivity

Answer: c) Thermal conductivity
Explanation: Thermal conductivity is a material property that determines how well it can conduct heat. Materials with high thermal conductivity transfer heat more quickly than those

with low thermal conductivity.

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5. Which coordinate system is commonly used to express Fourier’s heat conduction equation for cylindrical structures?

a) Cartesian coordinates
b) Polar coordinates
c) Spherical coordinates
d) Cylindrical coordinates

Answer: d) Cylindrical coordinates
Explanation: Fourier’s heat conduction equation can be expressed in various coordinate systems to describe heat transfer in different geometries. For cylindrical structures like pipes, cylindrical coordinates are commonly used.

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6. What is the thermal diffusivity of a material?

a) Its ability to absorb heat
b) Its ability to conduct heat
c) Its ability to store heat
d) Its ability to transfer heat relative to its thermal conductivity

Answer: d) Its ability to transfer heat relative to its thermal conductivity
Explanation: Thermal diffusivity is a measure of how quickly heat can diffuse through a material relative to its thermal conductivity. It is calculated as the ratio of thermal conductivity to the product of density and specific heat capacity.

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7. In one-dimensional steady-state conduction, what does “steady-state” imply?

a) Heat transfer rate is constant
b) Temperature distribution does not change with time
c) Heat source is continuously applied
d) Temperature gradient is constant

Answer: b) Temperature distribution does not change with time
Explanation: In one-dimensional steady-state conduction, the temperature distribution within the material does not change over time. This implies that the rate of heat transfer remains constant and there is no accumulation or depletion of heat within the material.

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8. What is the critical insulation thickness for pipes?

a) The minimum thickness of insulation required to prevent heat loss
b) The maximum thickness of insulation beyond which heat loss increases
c) The thickness of insulation at which heat gain equals heat loss

d) The thickness of insulation that maximizes heat transfer

Answer: a) The minimum thickness of insulation required to prevent heat loss
Explanation: Critical insulation thickness for pipes refers to the minimum thickness of insulation needed to minimize heat loss from the pipe surface. Below this thickness, the effectiveness of insulation in reducing heat loss decreases.

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9. Which law describes the relationship between the total amount of radiant energy emitted by a blackbody and its temperature?

a) Fourier’s Law
b) Newton’s Law of Cooling
c) Stefan-Boltzmann Law
d) Boyle’s Law

Answer: c) Stefan-Boltzmann Law
Explanation: Stefan-Boltzmann Law states that the total radiant energy emitted per unit surface area of a blackbody is directly proportional to the fourth power of its absolute temperature.

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10. How does the thermal resistance of a material affect heat transfer through it?

a) Higher resistance increases heat transfer
b) Higher resistance decreases heat transfer
c) Resistance has no effect on heat transfer
d) Resistance causes heat to accumulate

Answer: b) Higher resistance decreases heat transfer
Explanation: Thermal resistance impedes the flow of heat through a material. Higher thermal resistance reduces the rate of heat transfer, as it is harder for heat to pass through materials with greater resistance.

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11. Which type of heat transfer relies on the movement of fluid particles?

a) Conduction
b) Convection
c) Radiation
d) Advection

Answer: b) Convection
Explanation: Convection is the transfer of heat through the movement of fluid particles (liquids or gases). This movement can be natural (due to density differences) or forced (induced by external means such as fans or pumps).

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12. What analogy is often used to describe the flow of heat in terms of electrical circuits?

a) Ohm’s Law
b) Kirchhoff’s Law
c) Ampère’s Law
d) Faraday’s Law

Answer: a) Ohm’s Law
Explanation: Ohm’s Law, which describes the relationship between voltage, current, and resistance in an electrical circuit, is often used as an analogy to describe the flow of heat (thermal energy) in terms of temperature difference (analogous to voltage), heat transfer rate (analogous to current), and thermal resistance (analogous to electrical resistance).

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13. How does the thermal conductivity of a material affect its ability to conduct heat?

a) Higher thermal conductivity increases heat conduction
b) Higher thermal conductivity decreases heat conduction
c) Thermal conductivity has no effect on heat conduction
d) Thermal conductivity determines heat generation

Answer: a) Higher thermal conductivity increases heat conduction
Explanation: Thermal conductivity is a measure of a material’s ability to conduct heat.

Materials with higher thermal conductivity transfer heat more efficiently than those with lower thermal conductivity.

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14. What is the primary mode of heat transfer in a vacuum flask?

a) Conduction
b) Convection
c) Radiation
d) Advection

Answer: c) Radiation
Explanation: In a vacuum flask, heat transfer primarily occurs through radiation. The vacuum between the inner and outer walls of the flask prevents heat loss or gain by conduction or convection, leaving radiation as the dominant mode of heat transfer.

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15. Which equation governs the relationship between heat flux, temperature gradient, and thermal conductivity in a medium?

a) Fourier’s Law
b) Newton’s Law
c) Stefan-Boltzmann Law
d) Boyle’s Law

Answer: a) Fourier’s Law

Explanation: Fourier’s Law describes the relationship between heat flux (rate of heat transfer per unit area), temperature gradient (rate of change of temperature per unit distance), and thermal conductivity in a medium. It is fundamental to understanding heat conduction.

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