

Thermodynamics of the Universe

Thermodynamics · Practice Test · 20 Questions

1. What is the primary mechanism by which the Sun loses energy to the vacuum of space?

- A) Conduction
- B) Convection
- C) Radiation
- D) Advection

2. Which law of thermodynamics states that the entropy of a perfect crystal at absolute zero is zero?

- A) Zeroth Law
- B) First Law
- C) Second Law
- D) Third Law

3. What is the approximate temperature of the Cosmic Microwave Background radiation?

- A) 2.7 K
- B) 15 K
- C) 273 K
- D) 3000 K

4. In a star, what thermodynamic process primarily balances the inward gravitational pressure?

- A) Thermal expansion
- B) Nuclear fusion pressure
- C) Conduction of heat
- D) Phase change

5. Why do gas giants like Jupiter possess higher internal temperatures than their surface exposure suggests?

- A) Friction from moons
- B) Gravitational contraction
- C) Radioactive decay
- D) Internal nuclear fusion

6. What happens to the temperature of a gas cloud as it collapses under gravity, according to the adiabatic process?

- A) Decreases
- B) Remains constant
- C) Increases
- D) Fluctuates randomly

7. Which thermodynamic state is characterized by the absence of net energy flow between a planet and its environment?

- A) Thermal equilibrium
- B) Adiabatic expansion
- C) Entropy maximum
- D) Isochoric process

8. The Stefan-Boltzmann law relates the total energy radiated by a black body to which property?

- A) Mass
- B) Volume
- C) Temperature
- D) Density

9. Which fundamental thermodynamic quantity measures the degree of disorder or randomness in the universe?

- A) Enthalpy
- B) Entropy
- C) Internal energy
- D) Gibbs free energy

10. What is the state of a vacuum in terms of thermal conductivity?

- A) Highly conductive
- B) Moderately conductive
- C) Non-conductive
- D) Superconductive

11. What determines the color of a star based on Wien's Displacement Law?

- A) Surface temperature
- B) Chemical composition
- C) Mass
- D) Distance from Earth

12. Energy transfer in the radiative zone of the Sun occurs primarily through which particles?

- A) Protons
- B) Photons
- C) Electrons
- D) Neutrons

13. According to the Second Law of Thermodynamics, what happens to the total entropy of the universe over time?

- A) It decreases
- B) It remains constant
- C) It increases
- D) It resets periodically

14. Which phenomenon describes the cooling of an expanding universe?

- A) Adiabatic cooling
- B) Isobaric cooling
- C) Convective cooling
- D) Radioactive cooling

15. Heat transfer by conduction is negligible in outer space because space is a:

- A) High-pressure environment
- B) Dense plasma
- C) Near-perfect vacuum
- D) Supercooled liquid

16. The 'Heat Death' of the universe is a theoretical scenario based on the maximization of which thermodynamic property?

- A) Pressure
- B) Volume
- C) Entropy
- D) Temperature

17. What is the source of the high temperatures found in the solar corona compared to the photosphere?

- A) Nuclear fusion
- B) Magnetic reconnection
- C) Radioactive decay
- D) Gravitational collapse

18. Which thermodynamic cycle describes the theoretical behavior of heat engines, relevant to power generation in space probes?

- A) Carnot cycle
- B) Diesel cycle
- C) Otto cycle
- D) Rankine cycle

19. What is the primary form of heat transfer from the Sun to the Earth?

- A) Conduction
- B) Convection
- C) Radiation
- D) Evaporation

20. How does the density of a star's core affect its thermodynamic pressure?

- A) Higher density increases pressure
- B) Higher density decreases pressure
- C) Density is independent of pressure
- D) Pressure is solely dependent on volume