SET-C

1. **What type of star is formed when the outer layers of a red giant are ejected into space, leaving behind the core?**
   A) Main Sequence star
   B) White dwarf
   C) Black hole
   D) Neutron star

2. **What is the significance of the cosmic microwave background (CMB) in relativistic cosmology?**
   A) It provides evidence for dark matter
   B) It is a remnant of the hot early universe
   C) It indicates the presence of black holes
   D) It shows the distribution of galaxies

3. **Which aircraft was the first to break the sound barrier?**
   A) Concorde
   B) Bell X-1
   C) Boeing 747
   D) Lockheed SR-71

4. **What is the primary function of a rocket's nozzle?**
   A) To hold the fuel
   B) To ignite the fuel
   C) To accelerate the exhaust gases to produce thrust
   D) To stabilize the rocket's trajectory

5. **Which planet has the strongest gravitational pull in our solar system?**
   A) Earth
   B) Jupiter
   C) Saturn
   D) Mars

6. **What is the primary factor affecting the speed of sound in a medium?**
   A) Density of the medium
   B) Temperature of the medium
   C) Pressure of the medium
   D) Humidity of the medium

7. **What does the concept of redshift in the context of Hubble's Law indicate?**
   A) A galaxy is moving towards us
   B) A galaxy is moving away from us
   C) The galaxy's brightness is increasing
   D) The galaxy is at rest

8. **What is the neutrino flavor referring to?**
   A) The mass of the neutrino
   B) The interaction type of the neutrino

C) The specific type of neutrino (electron, muon, tau)
D) The energy level of the neutrino

9. **What happens to airflow around an aircraft when it transitions from subsonic to supersonic speed?**
   A) Airflow becomes more stable.
   B) Shock waves may form, causing increased drag.
   C) The airflow pattern remains unchanged.
   D) The aircraft experiences zero lift.

10. **What is the gravitational force experienced by an object at the center of a massive sphere?**
    A) Equal to the weight of the object
    B) Zero
    C) Equal to the force acting at the surface
    D) Maximum

11. **In astrophysical applications, how does the Saha equation help in understanding stellar atmospheres?**
    A) It calculates the total luminosity of a star.
    B) It determines the temperature gradients in stellar interiors.
    C) It predicts the ionization levels of elements based on temperature and pressure.
    D) It analyzes the motion of stars in galaxies.

12. **What happens to the observed frequency of light if the observer moves toward the light source?**
    A) The observed frequency decreases.
    B) The observed frequency increases.
    C) The observed frequency remains the same.
    D) The observed frequency fluctuates randomly.

13. **Why are neutrino detectors placed deep underground or in ice?**
    A) To reduce costs
    B) To minimize background noise from cosmic rays
    C) To increase detection sensitivity
    D) To stabilize the detectors

14. **What is the role of scintillators in neutrino detection?**
    A) To amplify neutrino signals
    B) To convert neutrino interactions into detectable light
    C) To stabilize the detector environment
    D) To cool the detector system

15. **What is the expected behavior of the scale factor over time in a universe dominated by matter according to the Friedmann Equation?**
    A) It decreases exponentially.

B) It remains constant.
C) It increases, but at a decreasing rate.
D) It increases indefinitely.

16. **What role does dark energy play in the framework of relativistic cosmology?**
    A) It causes gravitational attraction
    B) It is responsible for the accelerated expansion of the universe
    C) It contributes to the mass of galaxies
    D) It creates new matter in the universe

17. **What is the primary advantage of using liquid rocket engines?**
    A) Simplicity of design
    B) High thrust-to-weight ratio
    C) Reusability
    D) Thrust can be controlled during flight

18. **How does gravity vary with altitude?**
    A) Increases with altitude
    B) Remains constant
    C) Decreases with altitude
    D) Increases and then decreases

19. **Which of the following is a key assumption made in the derivation of the Saha equation?**
    A) The gas behaves ideally.
    B) The gas is incompressible.
    C) The gas is at rest.
    D) The interactions between particles are negligible.

20. **What happens to a star with a mass similar to our Sun after it exhausts its nuclear fuel?**
    A) It becomes a black hole
    B) It becomes a supernova
    C) It evolves into a white dwarf surrounded by a planetary nebula
    D) It expands into a red supergiant

21. **What effect does increasing dark energy density have on the expansion of the universe according to the Friedmann Equation?**
    A) It slows down the expansion.
    B) It accelerates the expansion.
    C) It causes the universe to collapse.
    D) It stabilizes the expansion rate.

22. **How does the concept of "scale factor" relate to the age of the universe in relativistic cosmology?**
    A) The age is inversely proportional to the scale factor
    B) The age is directly proportional to the scale factor
    C) The scale factor is independent of the universe's age
    D) The scale factor determines the future expansion rate only

23. **What is the main disadvantage of solid rocket motors?**
    A) They are too heavy.
    B) They cannot be turned off once ignited.
    C) They have a lower thrust-to-weight ratio.
    D) They require complex fuel handling systems.

24. **In what way could neutrinos help in understanding the early universe?**
    A) By providing evidence for dark energy
    B) By revealing conditions in the first moments after the Big Bang
    C) By measuring cosmic background radiation
    D) By tracking galaxy formation

25. **If Hubble's Constant is determined to be 70 km/s/Mpc, what would be the recessional velocity of a galaxy located 2 Mpc away?**
    A) 35 km/s
    B) 70 km/s
    C) 140 km/s
    D) 210 km/s

26. **Which experimental setup is used to study neutrinos produced by cosmic rays?**
    A) Super-Kamiokande
    B) IceCube Neutrino Observatory
    C) DUNE
    D) MINOS

27. **What is the expected mass range of neutrinos according to current theories?**
    A) 0.1 to 1 MeV
    B) Approximately 0 eV (but non-zero)
    C) 1 to 10 GeV
    D) 100 GeV to 1 TeV

28. **Which historical figure's data was crucial for Kepler's formulation of his laws?**
    A) Galileo Galilei
    B) Isaac Newton
    C) Tycho Brahe
    D) Nicolaus Copernicus

29. **What role do neutrinos play in the Standard Model of particle physics?**
    A) They are responsible for strong nuclear interactions.
    B) They are key to the formation of matter.
    C) They mediate gravitational forces.
    D) They are involved in weak nuclear interactions.

30. **What happens to the internal pressure and temperature of a star as it evolves into a red giant?**
    A) Both pressure and temperature decrease.
    B) Pressure increases, but temperature decreases.
    C) Pressure increases, and temperature increases.
    D) Pressure decreases, and temperature increases.