

# SET-D

**1.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

**2.What occurs when an object falls freely under the influence of gravity alone?**

- A) It experiences a constant speed.
- B) It accelerates at a constant rate.
- C) It decelerates over time.
- D) It moves in a circular path.

**3.In rocket propulsion, what does the term 'thrust-to-weight ratio' indicate?**

- A) The amount of thrust generated compared to the rocket's weight
- B) The efficiency of the rocket engine
- C) The total weight of the rocket
- D) The fuel consumption rate of the rocket

**4.What is the role of the oxidizer in a rocket engine?**

- A) To provide thrust
- B) To increase the temperature of the fuel
- C) To enable combustion of the fuel
- D) To stabilize the rocket's flight

**5.What role do neutrinos play in the Standard Model of particle physics?**

- A) They are responsible for strong nuclear interactions.
- B) They are mediators of electromagnetic forces.
- C) They are part of the lepton family and help explain weak interactions.
- D) They do not play a role in the Standard Model.

**6.Which property of neutrinos was confirmed by the discovery of neutrino oscillation?**

- A) They are massless.
- B) They have a defined charge.

- C) They can change from one type (flavor) to another.
- D) They only interact through gravitational force.

**7.What type of neutrino is specifically studied in the Sudbury Neutrino Observatory (SNO)?**

- A) Electron neutrinos
- B) Muon neutrinos
- C) Tau neutrinos
- D) All types of neutrinos

**8.In the context of neutrino detection, what is the significance of the term 'energy threshold'?**

- A) The minimum energy required for a neutrino to be detected
- B) The energy required to produce neutrinos
- C) The maximum energy limit for neutrinos
- D) The energy that neutrinos lose during interaction

**9.If an aircraft is flying at a Mach number of 2.0, what does this imply?**

- A) It is traveling twice the speed of light.
- B) It is traveling at the speed of sound.
- C) It is traveling twice the speed of sound.
- D) It is stationary.

**10.What is the significance of the critical Mach number?**

- A) It is the speed at which drag increases significantly.
- B) It is the speed at which a shock wave forms.
- C) It is the speed at which an object can no longer maintain altitude.
- D) It is the maximum speed limit for commercial aircraft.

**11.At which Mach number is an aircraft generally considered supersonic?**

- A) Greater than 0.8
- B) Equal to 1.0
- C) Greater than 1.0
- D) Less than 0.5

**12.Which of the following statements is true regarding transonic flight?**

- A) It occurs only at very low altitudes.
- B) It is characterized by a mix of subsonic and supersonic airflow.

- C) It has no impact on aerodynamic performance.
- D) It is faster than supersonic flight.

**13. Kepler's laws can be used to predict the behavior of which of the following celestial objects?**

- A) Only planets
- B) Only moons
- C) All celestial objects with orbits, including asteroids and comets
- D) Only artificial satellites

**14. What distinguishes a comet's orbit from that of a planet, according to Kepler's laws?**

- A) Comets always have circular orbits.
- B) Comets have highly elliptical orbits, which can be very elongated.
- C) Comets do not obey Kepler's laws.
- D) Comets orbit at a fixed distance from the Sun.

**15. What does a "light-year" measure?**

- A) Time taken by light to travel one year.
- B) Distance that light travels in one year.
- C) Speed of light over one year.
- D) The time it takes for Earth to orbit the Sun.

**16. What is the relationship between one astronomical unit and the orbits of planets?**

- A) It defines the radius of Earth's orbit around the Sun.
- B) It is the maximum distance any planet can reach from the Sun.
- C) It is used to measure the speed of planets in orbit.
- D) It is irrelevant to planetary orbits.

**17. In what scenario would you use a megaparsec (Mpc) as a unit of distance?**

- A) Measuring distances to planets.
- B) Measuring distances to stars within our galaxy.
- C) Measuring distances to other galaxies.
- D) Measuring distances to asteroids.

**18.What is one consequence of the discovery of Hubble's Law regarding the age of the universe?**

- A) The universe must be older than the light travel time to the farthest observed galaxies.
- B) The universe is infinitely old.
- C) The universe is younger than previously thought.
- D) The age of the universe cannot be determined.

**19.Which observational technology is crucial for studying the redshift of galaxies?**

- A) Radio telescopes
- B) Space probes
- C) Optical telescopes with spectrometers
- D) Ground-based observatories

**20.What do astronomers mean by "cosmological redshift"?**

- A) Redshift caused by the relative motion of galaxies.
- B) Redshift due to the expansion of space itself.
- C) Redshift resulting from gravitational effects.
- D) Redshift caused by interstellar gas clouds.

**21.In terms of wavelength, how does blueshift manifest?**

- A) Wavelengths are lengthened.
- B) Wavelengths are shortened.
- C) Wavelengths remain unchanged.
- D) Wavelengths are scattered.

**22.Which observational evidence supports the existence of dark energy, as described in the Friedmann Equation?**

- A) Cosmic microwave background radiation.
- B) The large-scale structure of the universe.
- C) The accelerated expansion of the universe observed through distant supernovae.
- D) The rotation curves of galaxies.

**23.Which factor contributes to the curvature of space in the Friedmann Equation?**

- A) The scale factor.
- B) The total energy density.
- C) The speed of light.
- D) The distance between galaxies.

**24.What is a consequence of the cosmological principle in relativistic cosmology?**

- A) The universe is heterogeneous.
- B) The universe looks the same from every point in space.
- C) The universe is contracting.
- D) The universe has a fixed structure.

**25.In relativistic cosmology, what is meant by "cosmic inflation"?**

- A) The steady expansion of the universe over time.
- B) A rapid exponential expansion of the universe in its early moments.
- C) The formation of structures like galaxies.
- D) The cooling of the universe as it expands.

**26.What does the term "redshift" indicate in the context of the relativistic Doppler effect?**

- A) A decrease in the energy of the light.
- B) An increase in the frequency of the light.
- C) An increase in the speed of light.
- D) A decrease in the speed of light.

**27.If a star is observed to be blue-shifted, what can be inferred about its motion relative to Earth?**

- A) The star is moving away from Earth.
- B) The star is stationary with respect to Earth.
- C) The star is moving towards Earth.
- D) The star's light is being absorbed by Earth's atmosphere.

**28.What happens to the ionization state of hydrogen as the temperature in a stellar atmosphere increases, according to the Saha equation?**

- A) The ionization state decreases.
- B) The ionization state remains constant.
- C) The ionization state increases.
- D) The ionization state fluctuates randomly.

**29.Which physical principle is fundamental to the derivation of the Boltzmann equation?**

- A) Conservation of momentum.
- B) Conservation of energy.
- C) Statistical mechanics.

- D) Classical thermodynamics.

**30. How does the radiation emitted by a blackbody compare to that emitted by a gray body?**

- A) A blackbody emits more radiation at all temperatures.
- B) A gray body emits less radiation at all temperatures.
- C) Both emit radiation equally at all temperatures.
- D) A gray body emits more radiation at higher temperatures.