SAT LONG READING 2

1 Reading passage

The discoveries of the white dwarf, the neutron star, and the black hole, coming well after the discovery of the red giant are among the most exciting developments in decades because they may be well present physicists with their greatest challenge since the failure of classical mechanics. In the life cycle of the star, after all of the hydrogen and helium fuel has been burned, the delicate balance between the outer nuclear radiation pressure and the stable gravitational force becomes disturbed and slow contraction begins. As compression increases, a very dense plasma forms. If the initial star had mass of less than 1.4 solar masses (1.4 times the mass of our sun), the process ceases at the density of 1,000 tons per cubic inch, and the star becomes the white dwarf. However, if the star was originally more massive, the white dwarf plasma can't resist the gravitational pressures, and in rapid collapse, all nuclei of the star are converted to a gas of free neutrons. Gravitational attraction compresses this neutron gas rapidly until a density of 10 tons per cubic inch is reached; at this point the strong nuclear force resists further contraction. If the mass of the star was between 1.4 and a few solar masses, the process stops here, and we have a neutron star.

But if the original star was more massive than a few solar masses, even the strong nuclear forces cannot resist the gravitational crunch. The neutrons are forced into one another to form heavier hadrons and these in turn coalesce to form heavier entities, of which we as yet know nothing. At this point, a complete collapse of the stellar mass occurs; existing theories predict a collapse to infinite density and infinitely small dimensions Well before this, however, the surface gravitational force would become so strong that no signal could ever leave the star - any photon emitted would fall back under gravitational attraction – and the star would become black hole in space.

This gravitational collapse poses a fundamental challenge to physics. When the most widely accepted theories predict such improbable things as infinite density and infinitely small dimensions, it simply means that we are missing some vital insight. This last happened in physics in the 1930's, when we faced the fundamental paradox concerning atomic structure. At that time, it was recognized that electrons moved in table orbits about nuclei in atoms. However, it was also recognized that if charge is accelerated, as it must be to remain in orbit, it radiates energy; so, theoretically, the electron would be expected eventually to spiral into the nucleus and destroy the atom. Studies centered around this paradox led to the development of quantum mechanics. It may well be that an equivalent t advance awaits us in investigating the theoretical problems presented by the phenomenon of gravitational collapse.

2 Question

1. What is the primary purpose of the passage?

(A) Offer new explanations for the collapse of stars.

(B) Explain the origins of black holes, neutron stars, and white dwarfs.

(C) Compare the structure of atoms with the structure of the solar system.

(D) Explain how the collapse of stars challenges accepted theories of physics.

(E) Describe the imbalance between radiation pressure and gravitational force.

2. According to the passage, in the final stages of its development our own sun is likely to take the form of a:

(A) white dwarf
(B) neutron star
(C) red giant
(D) gas of free neutrons
(E) black hole

3. According to the passage, an imbalance arises between nuclear radiation pressure and gravitational force in stars because:

(A) the density of a star increases as it ages
(B) radiation pressure increases as a star increases in mass
(C) radiation pressure decreases when a star's fuel has been consumed
(D) the collapse of a star increases its gravitational force.
(E) a dense plasma decreases the star's gravitational force.

4. The author asserts that the discoveries of the white dwarf, the neutron star, and the black hole are significant because these discoveries.

(A) demonstrate the probability of infinite density and infinitely small dimensions
(B) pose the most comprehensive and fundamental problem faced by physicists in decades
(C) clarify the paradox suggested by the collapse of electrons into atomic nuclei.
(D) establish the relationship between the mass and gravitational pressure.
(E) assist in establishing the age of the universe by tracing the life histories of stars.

5. The passage contains information that answers which of the following questions?

I. What is the density limit of the gravitational collapse of neutron stars?

II. At what point in its life cycle does a star begin to contract?

III . What resists the gravitational collapse of a star?

(A) I only
(B) III only
(C) I and II only
(D) II and III only
(E) I, II, and III

6. The author introduces the discussion of the paradox concerning atomic structures(in highlighted text) in order to

(A) Show why it was necessary to develop quantum mechanics
(B) Compare the structure of an atom with the structure of star
(C) Demonstrate by analogy that a vital insight in astrophysics is missing
(D) Illustrate the contention that improbable things do happen in astrophysics
(E) Argue that atoms can collapse if their electrons do not remain in orbit.

7. According to the passage, paradoxes are useful in a scientific investigation because:

(A) They point to the likelihood of impending discoveries.
(B) They assist scientists in making comparisons with other branches of knowledge.
(C) They disprove theories that have been called into question
(D) They call attention to inadequacies of existing theory
(E) They suggest new hypotheses that can be tested by observation

3 Answer

Question	1	2	3	4	5	6	7
Answer	D	A	C	B	E	C	D