White Dwarfs

I. Physical Characteristics

1. Define the term white dwarf.

White Dwarf - Small, dense star formed when a Low-Mass star exhausts all fuel and sheds outer layers

2. Identify the following physical characteristics of a white dwarf.

Diameter : Size of Earth

Chemical Composition : Carbon + Oxygen

Surface Temperature : 180,000 °F

Luminosity : 1/1000 th the brightness of the Sun

Matter : 1 teaspoon = 5.5 tons on Earth

3. White Dwarfs are always white in appearance.

Choose One : True (False)

II. Examples of White Dwarfs

1. List the constellations in which the following White Dwarfs can be located and who discovered the white dwarf.

1. 40 Eridani : Eridanus (The River) William Herschel (1783)
2. Sirius B : Canis Major (The Great Dog) Friedrich Bessel (1844)
3. Procyon B : Canis Minor (The Lesser Dog) Friedrich Bessel (1844)
4. Van Mannen's Star : Pisces (The Fisher) Adriann van Maanen (1917)
5. M4 Globular Cluster : Scorpius (The Scorpion) Hubble Space Telescope (1995)

III. Existence Of White Dwarfs

1. How long do White Dwarfs typically exist?

10 - 100 billion years

2. What is the name of the closest White Dwarf to Earth?

Sirius B (8.6 light years)

3. What stage of stellar evolution do White Dwarfs exist?

Last stage of Low-Mass star life

4. What is the future of a White Dwarf after its existence?

- Run out of fuel (Black Dwarf?)

Black Dwarfs

II. Physical Characteristics

1. **Define the term black dwarf.**

   Black Dwarf - theoretical stellar remnant that no longer emits heat or light (cooled white dwarf)

2. **Black dwarfs have never been discovered.**

   Circle One : (True) False

3. **Why haven't black dwarfs been discovered yet?** (very dark)

   - Only detectable through gravitational influence

4. **Theoretically, how long does it take for a black dwarf to form?**

   1 quadrillion years (1,000,000,000,000,000 years)

5. **Identify the following theoretical physical characteristics of a black dwarf.**

   Diameter : Size of Earth

   Chemical Composition : Depleted carbon

   Surface Temperature : 5 K (at most) (-268.15 °C)

   Luminosity : Very little radiation

   Matter : EXTREMELY dense

6. **Black dwarfs can be formed from which types of stars.**

   1. Low-Mass Star 2. Medium-Mass Star

II. Existence Of Black Dwarfs

1. **List three reasons why Black Dwarfs have not been discovered.**

   1. Universe is too young to create black dwarfs
   2. Slowed by dark matter / proton decay
   3. Slow cooling rate of white dwarfs (trillions of years)

2. **What stage of stellar evolution do Black Dwarfs exist?**

   - None detected yet (End?)

3. **What is the future of a Black Dwarf after its existence?**

   - Unknown