**Video: Hubble in Space -Answers**

1. What do stars form from?

**Nebulas (i.e., clouds of dust and gas)**

1. Explain the process in which stars are formed.

**Stars form from nebulas of gas and dust, in which the hydrogen gas clumps (accretes) together. When temperature and mass of the star is high enough, the hydrogen atoms collide and fuse together. This fusion is the birth of the star.**

1. Stars: Nuclear **fusion** or fission?

**FUSION**

1. How do solar systems and planets form?

**They form from the accretion (clumping) of dust and debris in orbit around a star. At the birth of a star (fusion), stellar winds (heat & radiation from a star) blow away the remaining hydrogen gas. The leftover debris that is not blown away by stellar winds accretes/clumps together over time, to form the planets of the solar system.**

1. What is the life cycle of a star?

**Low and Medium Mass Stars**

Nebula -> accretion of hydrogen gas -> formation of protostar (proto-planetary disc) -> fusion -> formation of low/medium mass star -> solar system formation (planets and moons in orbit) -> expansion of gas into a red giant -> leftover white dwarf -> completely cooled black dwarf

**High Mass Stars**

Nebula -> accretion of hydrogen gas -> formation of protostar (proto-planetary disc) -> fusion -> formation of high mass star -> solar system formation (planets and moons in orbit) -> supergiant -> supernova -> formation of neutron star or black hole

1. How many years before the sun will run out of hydrogen fuel and turn into a red giant?

**5 billion years**

1. What will the sun then turn into after shedding its outer layers and leaving behind an inert mix of fused carbon and oxygen?

**White Dwarf**

1. What is a supernova? Why can’t our sun supernova?

**Supernova is the explosion of a high mass or supermassive star. Our sun is not big enough to supernova.**

1. Explain the balance between a star’s gravity and fuel?

**Gravity wants to collapse (crush) the star inward and fusion wants to blow the star up – this pull in (gravity) and push out (fusion) is equalized and neither occurs until the death of the star (runs out of hydrogen or creates iron)**

1. Where are the basic elements of all life found?

**Created in the cores of stars – released into the universe during a supernova**

1. Explain a black hole. (how it’s created, theory, evidence, etc.)

**-A black hole begins with a star 4 times the size of our sun. It is formed when the core of a high mass star collapses in on itself during a supernova. The leftover core collapses down to a super small pinpoint, known as a singularity. This point of matter is so dense and has such a strong gravitational force/field that not even light can escape.**

**-Theory comes from Einstein’s General Theory of Relativity.**

**-The evidence comes from how stars move within a galaxy; zooming around the center of the galaxy. Also, images of jets of energy emanating from the hearts of black holes (e.g., M87)**

1. How do galaxies move and rotate?

**They move individually (spin – spiral) and they move in clusters of universes, and they are moving away from the starting point of the universe (Big Bang).**

1. How many stars in one galaxy? (side note- over 1 trillion planets in one galaxy)

**Over 100 billion**

1. Our Milky Way is what type of galaxy?

**Spiral galaxy**

1. How many galaxies in the universe?

**Over 100 billion**

1. What is the unknown, invisible matter that holds the universe together, like gravitational glue?

**Dark Matter**

1. Is there more dark matter than physical matter in the universe?

**Yes, 5 times more dark matter than physical matter.**

1. Is the universe expanding at an accelerated rate? Explain your answer.

**Yes, dark energy is speeding up the rate of expansion. The universe is not slowing down from the Big Bang. It is speeding up because dark energy is pushing everything in the universe apart.**

1. What is the invisible energy, that is opposite to gravity, which will someday cause everything to lose its binding forces that hold it together, even down to the subatomic level?

**Dark Energy**

1. What is the Big Rip theory?

**The theory that all matter in the universe will be ripped apart by dark energy; down to the smallest parts of an atom (subatomic level).**

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The **Universe** is defined as everything that [physically](http://en.wikipedia.org/wiki/Physically) [exists](http://en.wikipedia.org/wiki/Exists): the entirety of [space](http://en.wikipedia.org/wiki/Space) and [time](http://en.wikipedia.org/wiki/Time), all forms of [matter](http://en.wikipedia.org/wiki/Matter), [energy](http://en.wikipedia.org/wiki/Energy) and [momentum](http://en.wikipedia.org/wiki/Momentum), and the [physical laws](http://en.wikipedia.org/wiki/Physical_law) and [constants](http://en.wikipedia.org/wiki/Physical_constant) that govern them.

A **galaxy** is a massive, [gravitationally bound](http://en.wikipedia.org/wiki/Gravitation) system that consists of [stars](http://en.wikipedia.org/wiki/Star) and [stellar remnants](http://en.wikipedia.org/wiki/Stellar_remnant), an [interstellar medium](http://en.wikipedia.org/wiki/Interstellar_medium) of gas and [dust](http://en.wikipedia.org/wiki/Cosmic_dust), and an important but poorly understood component tentatively dubbed [dark matter](http://en.wikipedia.org/wiki/Dark_matter).

Our [**Solar System**](http://en.wikipedia.org/wiki/Solar_System) includes the Earth and all the other objects that orbit the Sun.