

1960's

# THE BIG BANG THEORY

13 billion years old

## THE UNIVERSE

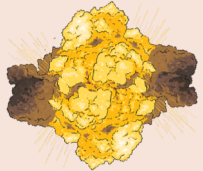


The Universe is defined as "...everything we can touch, feel, sense, measure or detect. It includes living things, planets, stars, galaxies, dust clouds, light, and even time. Before the birth of the Universe, time, space and matter did not exist."

### The Big Bang

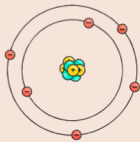
Before the Big Bang, the universe was inside a bubble that was smaller than a pinhead.

When the universe exploded (Big Bang), nearly 14 billion years ago, it created time, space and galaxies.



### Seconds after the Big Bang, particles began to form

A particle is a tiny amount of matter. These were called protons and neutrons. The protons and neutrons began to join to make simple chemical elements.



### 300,000 years later

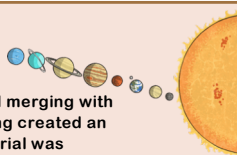
Years later, the universe had cooled down after the Big Bang and was cool enough for more chemical elements to form. The first stars also began to form.

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	H																		
2	Li	Be	B	C	N	O	F	Ne											
3	Na	Mg	Al	Si	P	S	Cl	Ar											
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Cobalt	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
8				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
9				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
10				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
11				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
12				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
13				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
14				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
15				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
16				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
17				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi
18				Rf	Db	Sg	Bh	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi

### 10 Billion Years Later

Our solar system and the Sun were formed.

The Earth was formed by rocks colliding and merging with one another. The impact of the rocks colliding created an incredible amount of heat. Radioactive material was delivered to the Earth as well. When the outer layer of the Earth cooled, this radioactive heat was trapped inside. The Earth's core is as warm as the Sun!



### Conclusion → We don't need God!

The Big Bang theory has led Hawking and many other scientists to conclude that there is no evidence to suggest that there is a Creator responsible for the origin of the universe; instead things may have happened by themselves.

The theory was first put forward by a Catholic priest, Father Georges Lemaitre, and then much later built on by Professor Stephen Hawking. The theory arose as a result of various observations made about the universe.

The best known theory explaining how the world began is the Big Bang theory which became widely accepted in the 1960s.



Stephen Hawking

*The laws of physics are enough to trigger the Big Bang, God is not needed for this.*

*'Before we understood science, it was natural to believe that God created the universe, but now science offers a more convincing explanation.'*



Father Georges Lemaitre

### Evidence for the Big Bang

One big piece of evidence to support the Big Bang theory is that galaxies and stars are now moving further away from us. This supports the idea that the Universe was once trapped inside a tiny bubble.

### The Catholic Church

The Catholic Church has no reason to question the evidence that scientists present about the origins of the universe. There is a long history of the Catholic Church being interested in, and leading on, areas of scientific discovery. In fact, it doesn't have to be a choice between religion and science because both are perfectly possible.



### AUTHORS OF GENESIS: WHY?

The story was told in a non-scientific age to explain that God was the creator of everything and that he had a special role for humanity to play in the world. These stories express meaning rather than presenting a factual account of historical events.

### SCIENTISTS: HOW?

Scientists are answering the question of HOW the universe was created. The conclusion for Catholics, therefore, is that if the Big Bang theory is correct then perhaps that is the way God chose to create the world.

### Moment of singularity...

As you observe these galaxies and their stage of development, it seems to suggest that the universe is about 15 billion years old, which has led scientists to believe that there was a one-off moment when it all began, and before which nothing existed.

Hawking calls this a 'moment of singularity'.

### Religion Versus Science

Today, many think of science and religion as being in opposition to each other, but this view is far too simplistic. *Up until the sixteenth century, the philosophers and theologians were the scientists; it was from their work that science was born.* In Medieval times belief about the structure of the universe was based on what scholars observed and mathematics. Any scientific reasoning was in line with the Christian faith and the accounts of Creation in Genesis. Scholars at this time were more interested in how you should live your life so that you could enter heaven rather than knowing how the universe worked. The accepted view at this time was that the earth had been created by God, as described in Genesis.

*Since those times, science has developed and, as a result, some theories that have been put forward appear to contradict the biblical accounts of creation. The study of the origin of the universe is called cosmology.* One of the first challenging ideas for many religious believers was the discovery that the earth went around the sun along with the other planets, rather than being the centre of the universe, as had previously been believed.

Furthermore, scientists have concluded that the world is a lot older than we first thought and *today it is believed that the universe is more than 13 billion years old*, with our sun forming about 4.6 billion years ago.

The theory raises almost as many questions as answers



*Where did the matter come from that caused the Big Bang?*

Hawking suggests that since gravity exists, the universe can and will create itself from nothing, but the question is, *where did the law of gravity come from?* Gravity and matter are not 'nothing', so if either of these existed before the universe, then the universe has not come from nothing.

Did the universe come from nothing? (ex nihilo)

### Knowledge Check

- Who first put forward the theory of the Big Bang?
- What is the Universe defined as?
- Why does Stephen Hawking say that God is not needed to trigger the Big Bang?
- What happened when the universe exploded?
- What evidence is there to support the Big Bang?
- How does the Catholic Church interpret the Big Bang theory?
- What is meant by a 'moment of singularity'?
- What big questions does the Big Bang theory raise?

### Choose a Task

- Create a detailed mind-map (try to make this visual)
- Create a multiple-choice quiz (aim for at least 10 questions)
- Create a poster/leaflet

### CHALLENGE!

Turn over the mat and try to complete your task without looking at the information. Then refer back to the task mat to see what you have missed/could have included.

### Exam Question

- Describe the scientific theory of the Big Bang [5]
- Explain two different Christian attitudes towards the Big Bang [8]