

Is there life beyond Earth?

with Dame Dr Maggie Aderin-Pocock

Royal Institution Christmas Lectures Activities

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In this year's CHRISTMAS LECTURES from the Royal Institution (Ri) supported by CGI, Dr Dame Maggie Aderin-Pocock will take us on an epic voyage through time and space.

Scientists in 2025 detected the 'strongest hint yet' of biological activity outside our solar system on exoplanet K2-18b, sparking growing excitement about the real possibility of extraterrestrial life. In this series of lectures, Maggie sets out on a journey to find it.



Decode the Arecibo Message and Make Your Own!

This is a Key Stage 2 school resource to decode an Arecibo message and create your own. It includes the golden record – what music and words would you send to aliens?

Learning Objectives

- Learn what the Arecibo Message is
- Design your own Arecibo Message

What is the Arecibo Message?

Over 50 years ago in 1974, scientists sent a message into space using a huge radio telescope in Puerto Rico. The Arecibo (ah-reh-see-boh) Message was sent to a big group of stars called Messier 13. It was made up of 1,679 bits of data – like little digital puzzle pieces. When you put them in the right order, they make a picture!

What is in the Message?

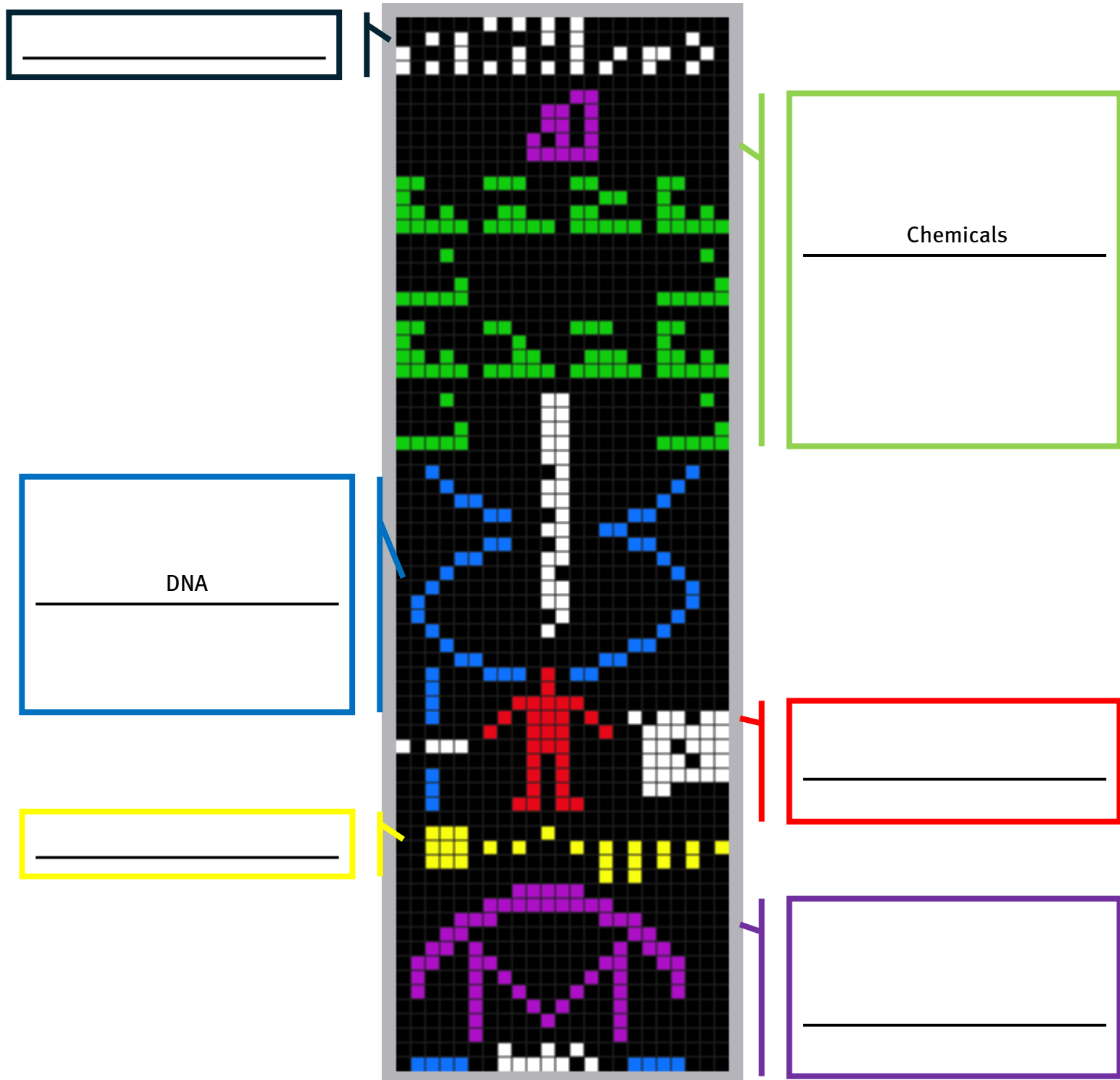
Here are the different parts of the picture:

- **Numbers from 1 to 10** – to show how we count
- **Chemical elements** – the building blocks that make up our bodies
- **DNA patterns** – to show what makes humans special
- **A person** – showing what we look like and how tall we are
- **The solar system** – with Earth sticking up to show where we are
- **Arecibo telescope** – how the message was sent

Activity 1: Label the Arecibo Message

Here is what the message looked like (colour has been added to help you see the parts clearly)

Label each part of the picture: planets, human, telescope, numbers.



Activity 2: Using Binary Code to make a picture

This message was made of binary code. This is where 0s and 1s make a picture. Here's an example to show how it works:

The 1 digits represent a shaded in part of the image, the 0 digits represent a blank square.

Row 1: 0000000000

Row 2: 0010000100

Row 3: 0000000000

Row 4: 0100000010

Row 5: 0011111100

Row 6: 0000000000

1									
2									
3									
4									
5									
6									

Use these sets of binary code to make an image. Shade in the blocks which are represented by 1.

Image 1

Row 1: 00110001100

Row 2: 01001010010

Row 3: 10000100001

Row 4: 10000100001

Row 5: 01000000010

Row 6: 00100000100

Row 7: 00010001000

Row 8: 00001010000

Row 9: 0000010000

1										
2										
3										
4										
5										
6										
7										
8										
9										

What does this image look like?

Image 2

Row 1: 00100000100

Row 2: 00010001000

Row 3: 00111111100

Row 4: 01101110110

Row 5: 11111111111

Row 6: 10111111101

Row 7: 10100000101

Row 8: 00011011000

1											
2											
3											
4											
5											
6											
7											
8											

What does this image look like?

Image 3

Let's reverse it. See if you can work out the binary code from this image

Row 1: _ _ _ _ _

Row 2: _ _ _ _ _

Row 3: _ _ _ _ _

Row 4: _ _ _ _ _

Row 5: _ _ _ _ _

Row 6: _ _ _ _ _

Row 7: _ _ _ _ _

Row 8: _ _ _ _ _

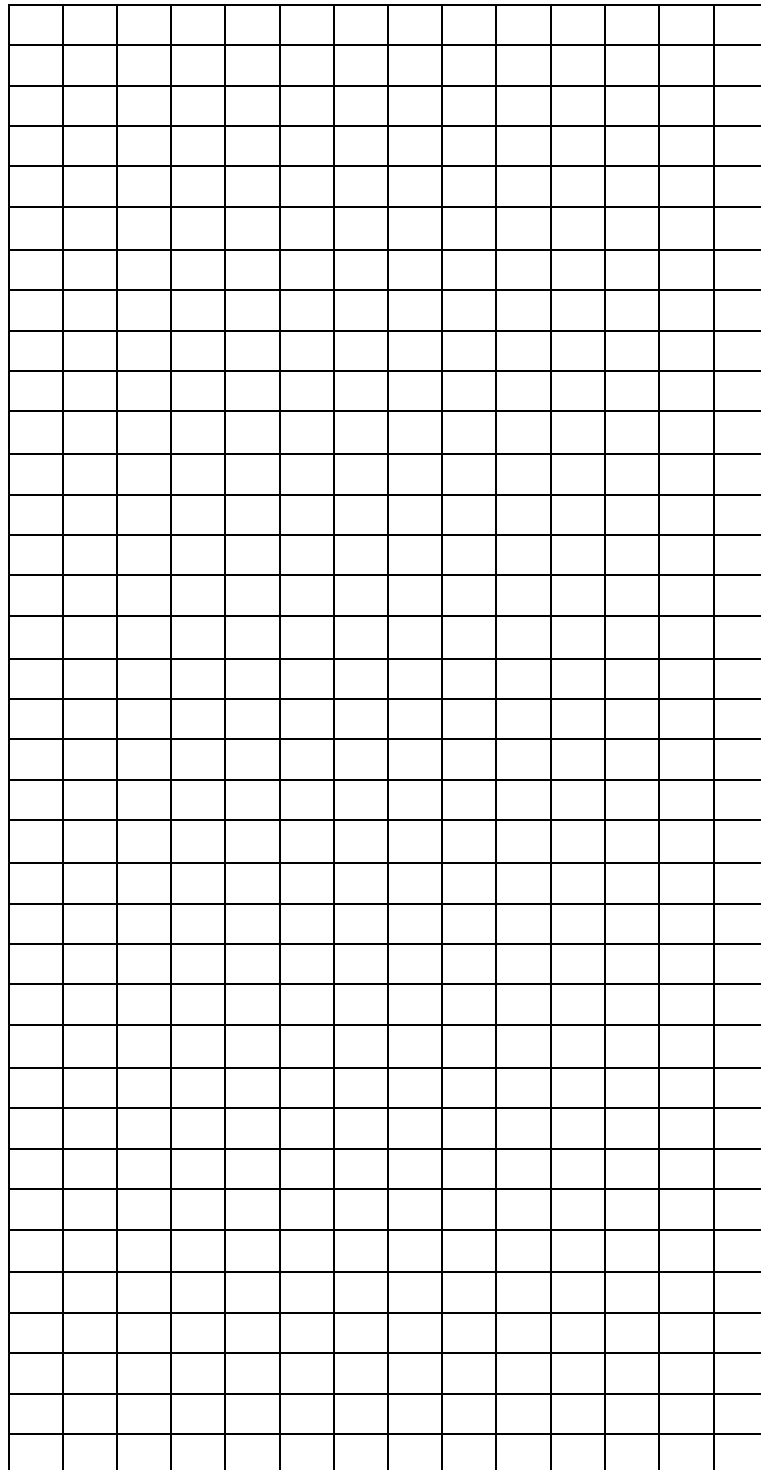
1									
2									
3									
4									
5									
6									
7									
8									

Activity 2: Design Your Own Space Message!

Imagine you want to send a message into space.

- What would you want to say?
- What's important about life on Earth?
- Can you turn your ideas into a picture like the Arecibo message?

Use colours, symbols, and shapes to show what makes Earth special.



Extension: The Arecibo message isn't the only way we've tried to talk to life beyond Earth. In 1977, NASA sent two spacecraft into space called Voyager 1 and Voyager 2. Each one carried something very special — a Golden Record!

These Golden Records were like space-time capsules. They were made to show what life is like on Earth, just in case aliens ever find them.

Each record included:

- Greetings in 55 different languages from around the world
- Natural sounds, like thunder, birds singing, and waves in the ocean
- Music from different countries and time periods
- Pictures and information that explain how to play the record and facts about science

These records are now far out in space — still traveling and waiting to be found!

Challenge:

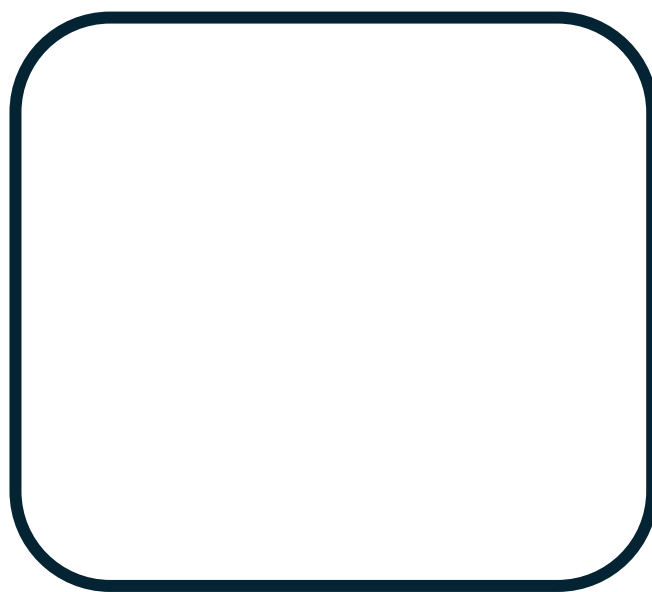
If you were creating a new version of the Golden Record, what would you include?

What messages, sounds, or songs would best represent life on Earth today?

Make a playlist of audio you'd choose—this could include nature sounds, music from around the world, or even personal messages.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Design your own playlist cover for your Golden record:



Answer sheet: **Label the Arecibo Message**

Numbers (1 to 10)

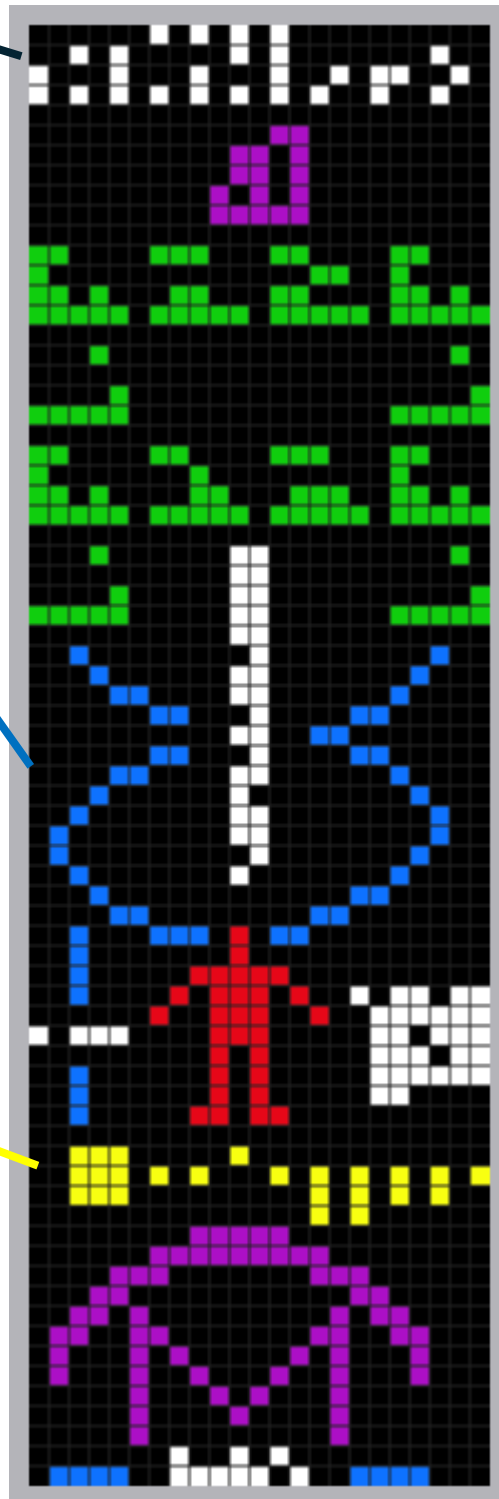
Atomic numbers

DNA

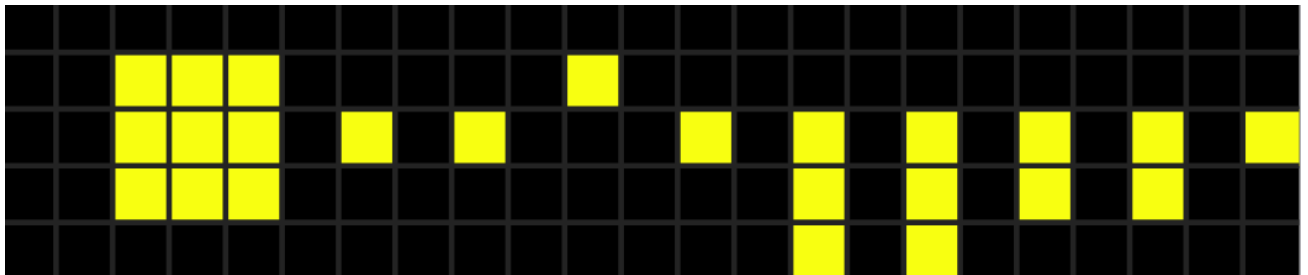
Human

Solar system

Arecibo telescope



Label the planets:



Sun Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto

Activity 2: Using Binary Code to make a picture

Image 1

Row 1: 00110001100

Row 2: 01001010010

Row 3: 10000100001

Row 4: 10000100001

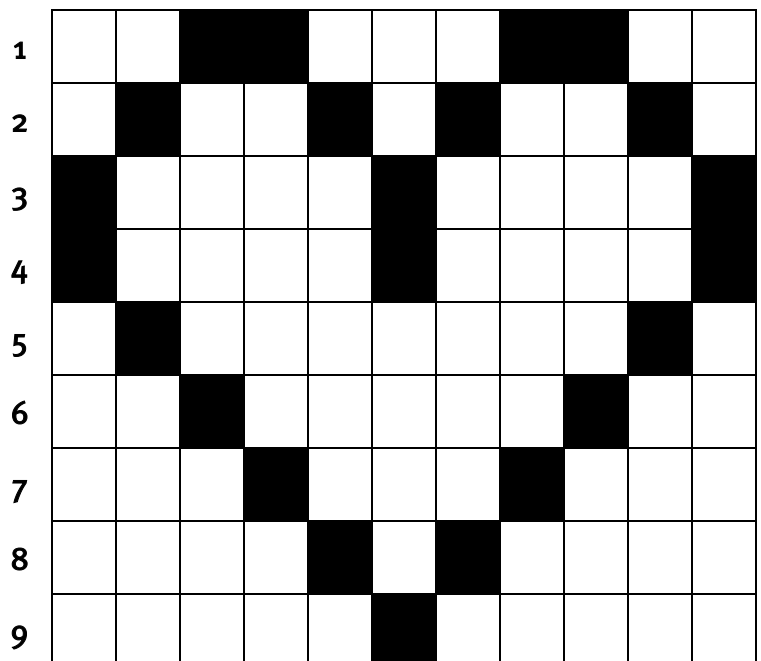
Row 5: 01000000010

Row 6: 00100000100

Row 7: 00010001000

Row 8: 00001010000

Row 9: 00000100000



This image shows a heart

Image 2

Row 1: 00100000100

Row 2: 00010001000

Row 3: 00111111100

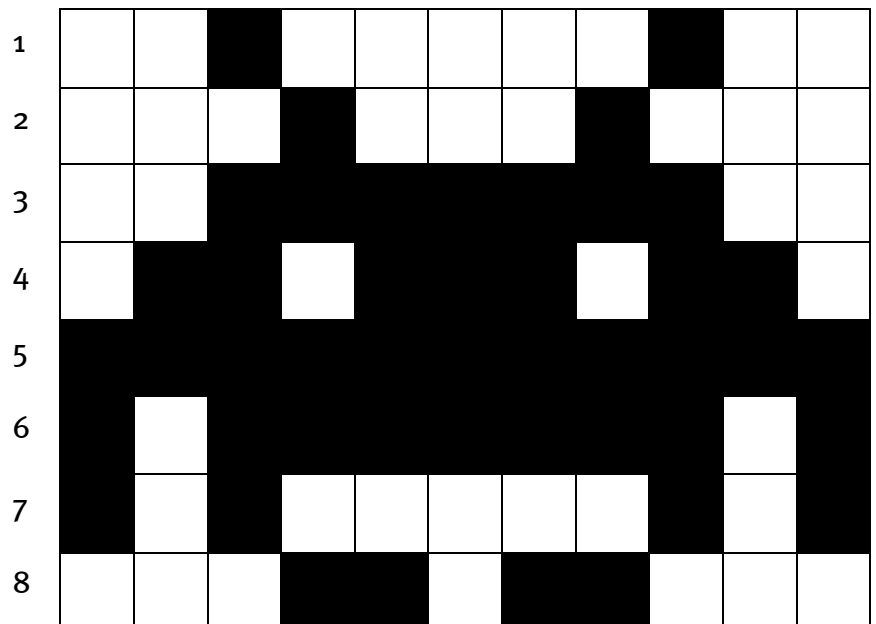
Row 4: 01101110110

Row 5: 11111111111

Row 6: 10111111101

Row 7: 10100000101

Row 8: 00011011000



This image shows a space invader/ alien

Image 3

Image 3

Let's reverse it. See if you can work out the binary code from this image

Row 1: 001101100

Row 2: 001101100

Row 3: 110000011

Row 4: 110000011

Row 5: 001111100

Row 6: 011111110

Row 7: 011111110

Row 8: 001101100

