

Make your own Astronomical Diagram

Astronomy and Geometry The Golden Age in Baghdad

Draw an astronomical diagram for the time of the founding of Baghdad using information compiled by **Al Biruni** the great scientist.

You will need:

- 2 Pieces of paper
 - 1 Pencil
 - 1 Ruler
 - 1 Rubber
 - 2 Round items that are different sizes to draw round (a small plate, saucer, dish, just raid the kitchen)
 - 1 pair scissors
- You can of course use compasses as well.



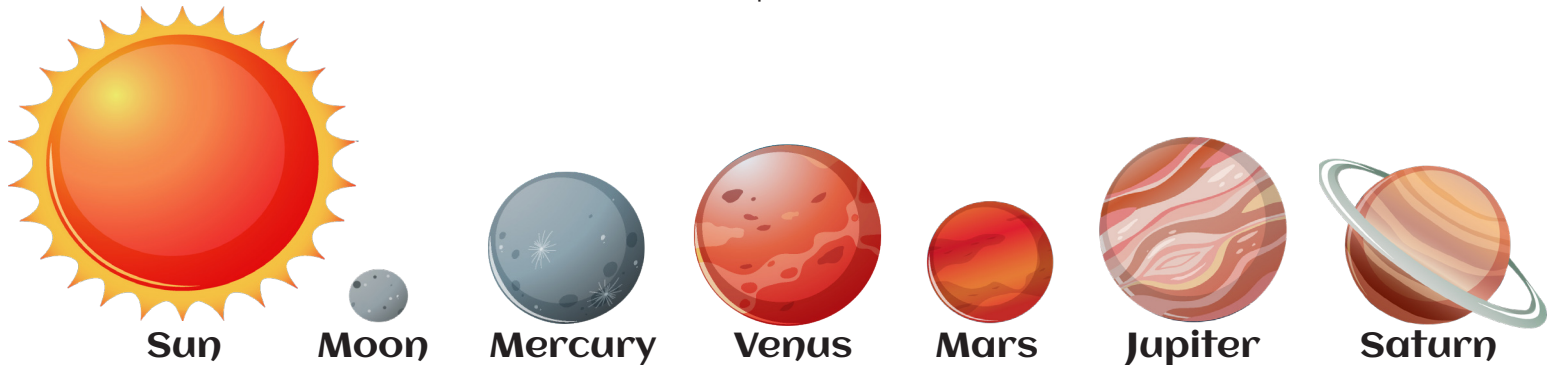
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Today we know that the sun is at the centre of our solar system.

Al Biruni wrote that some believed it was the earth that moved and others did not, so the later astronomers knew that Islamic scholars had begun the discussion on this idea hundreds of years before Copernicus wrote about it.

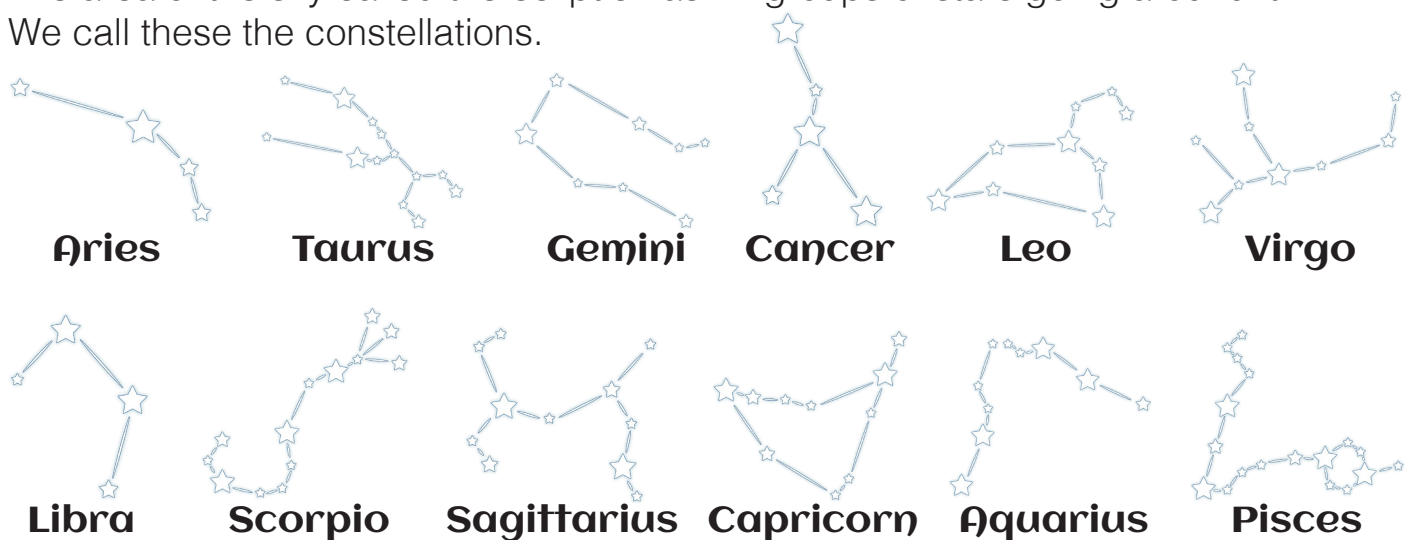
List the 8 planets including earth in order from the sun.

In the medieval world we will record the positions of the:



These heavenly bodies appear to travel around the earth in the same direction in a narrow belt of the sky known as the ecliptic. Astronomers in Baghdad, working in the House of Wisdom observatory and library, worked out the accurate angle of the ecliptic compared to the earth.

The area of the sky called the ecliptic has 12 groups of stars going around it. We call these the constellations.

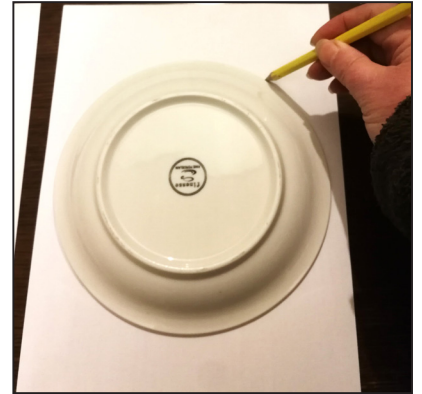


Since very ancient times people have looked up at the stars and have used these constellations to work out what time of year to plant, harvest, go sailing, have feasts or other special days. They do this by knowing what sign of the zodiac the sun is passing in front of. In Baghdad, scholars came from many different countries to put together their knowledge of the movements of the planets, comets, even eclipses (when the sun or moon appear to have a shadow across them). Because this was all written down in Baghdad, we even know what the skies looked like when Baghdad was first built!



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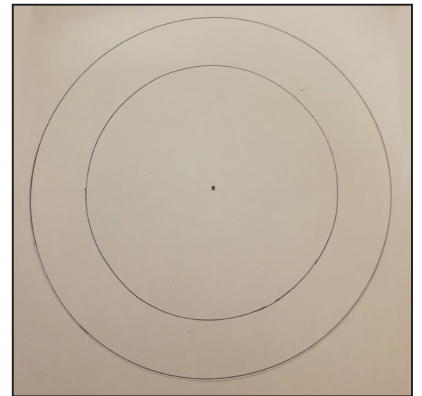
1. Place your biggest plate, bowl, on your paper and draw round it.



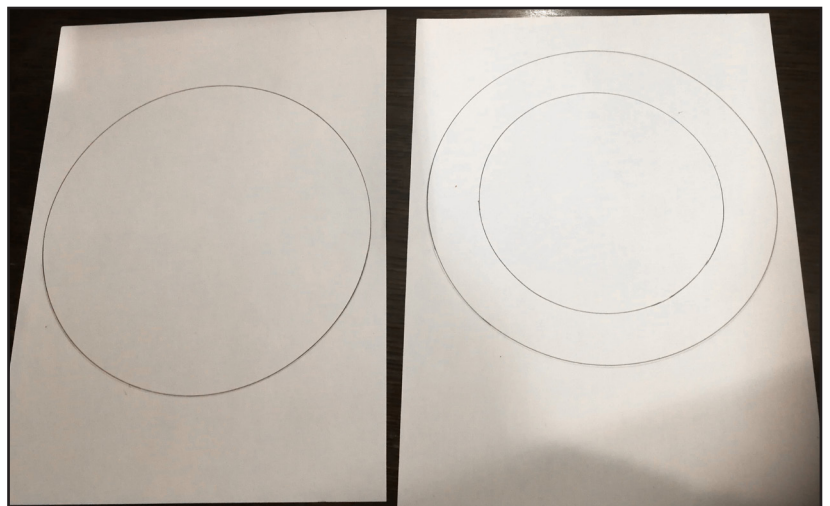
2. Do the same on another piece of paper as well.



3. Now put your smaller round thing in the middle of one of your drawn circles and draw around this. You should now have two circles, with a gap between them.

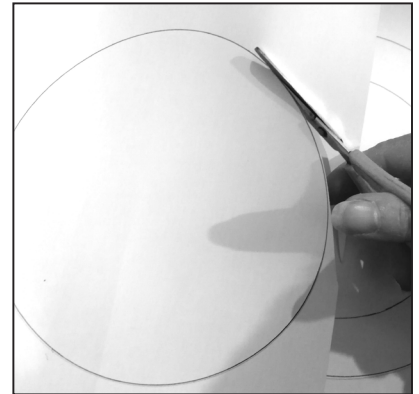


You should now have two sheets of paper looking like this.



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4. Cut the paper with one circle. As shown.



5. Fold it in half from left to right.

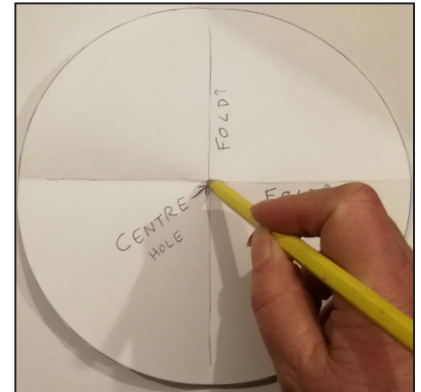


6. Then open it and fold it again top to bottom.

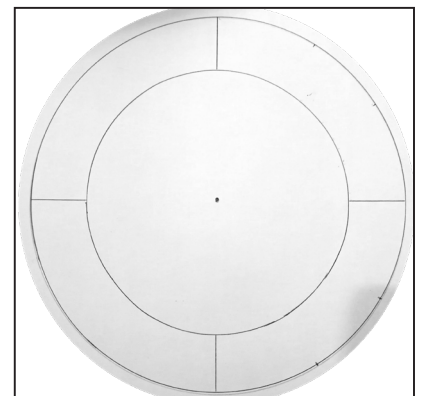


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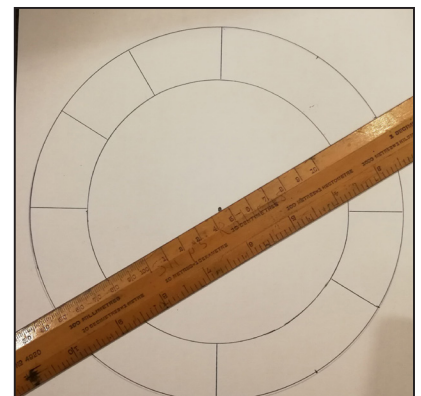
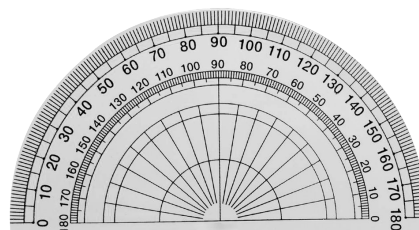
7. Make a hole where the lines cross and you have found the centre. Make a hole in the centre. Lay this over your double circle and use your pencil to mark the centre of the double circle.



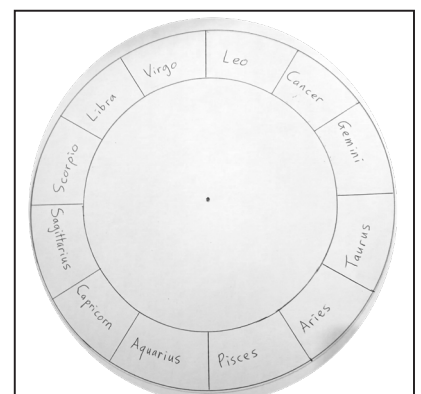
8. Divide the area between your big and small circle into 4, then 12 sections, using the centre spot as a guide.



9. You can guess the distances between the sections or if you have a *protractor* you can measure it out.



10. Now write in the names of the 12 zodiac signs. Make sure you put the signs in the right order, and in exactly the same place, as on this diagram.

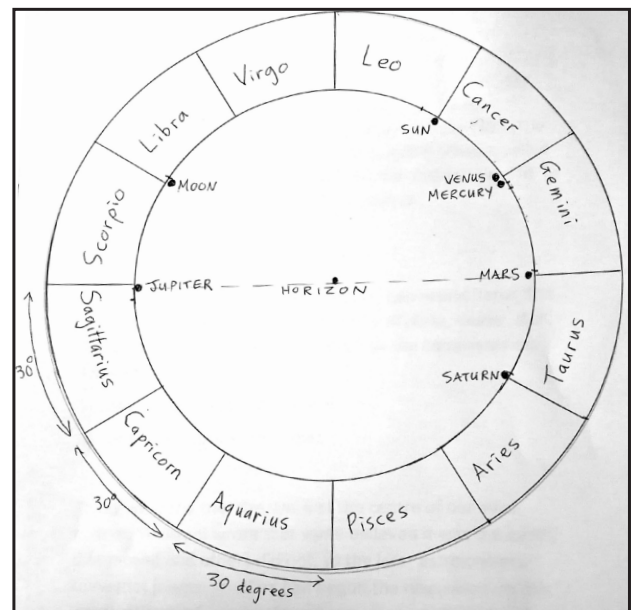
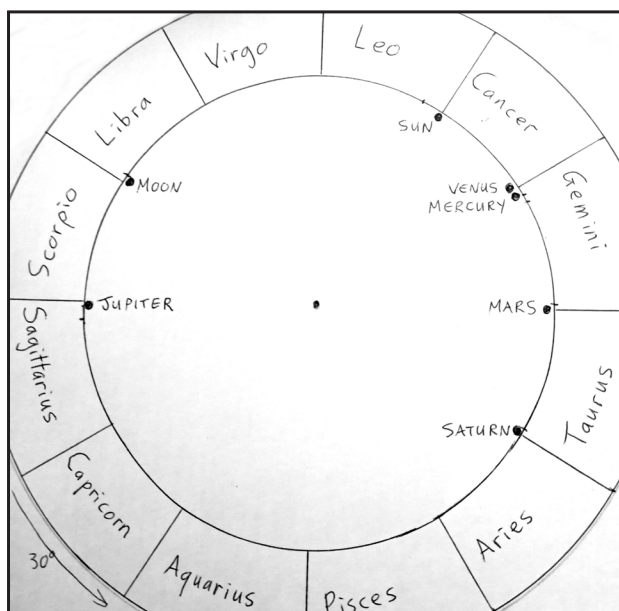


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11. Each sign measures 30 degrees. *Al Biruni* gives us the positions for the sun, moon and planets at the time of the founding of Baghdad but Saturn was added by a later astronomer. They are shown in the table below.

To make it easier just use the joins between the signs as we do not need to be really accurate for this activity. So, for the sun, put a dot on your inner circle where Cancer and Leo join. Then write sun inside the inner circle, so you know that this dot represents the sun.

Sun	8° 10"	In Leo	Put a dot between Cancer and Leo
Moon	29° 10"	In Libra	Put a dot between Libra and Scorpio
Mercury	25° 7"	In Gemini	Put a dot between Gemini and Cancer
Venus	29° 8"	In Gemini	Put a dot between Gemini and Cancer
Mars	2° 50"	In Gemini	Put a dot between Taurus and Gemini
Jupiter	6° 0"	In Sagittarius	Put a dot between Scorpio and Sagittarius
Saturn	1° 40"	In Taurus	Put a dot between Aries and Taurus



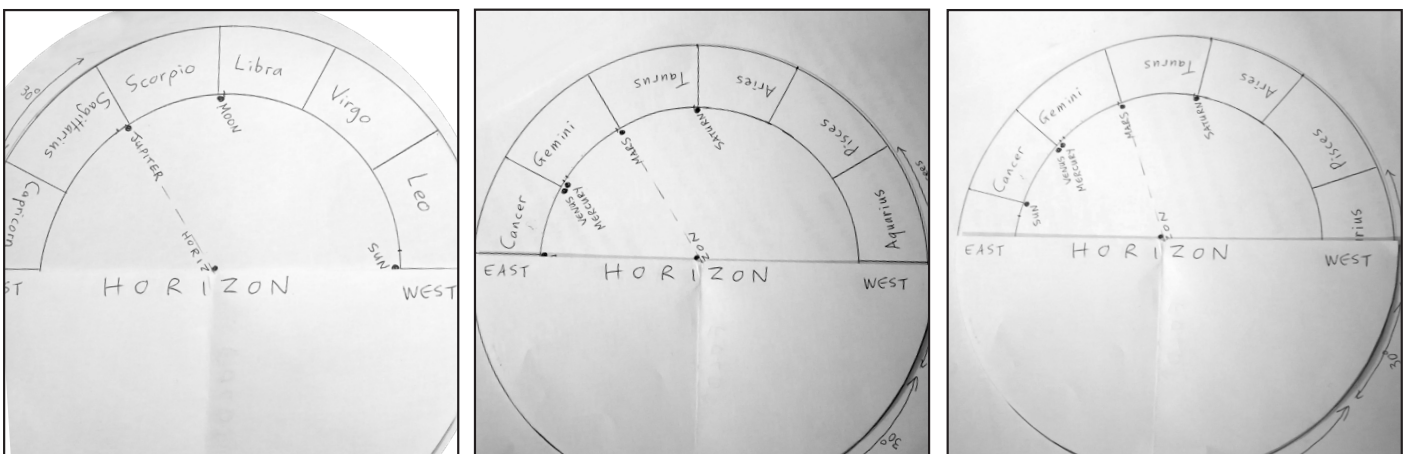
12. Do this for each of the heavenly bodies, marking the point on the inner circle with a big dot. Then write the name of the planet next to it, inside the inner circle. You will have to put Mercury and Venus next to each other

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13. Now you have a map of the sun, moon and planets as they appeared on the very day that Baghdad was founded! You should see that the sun is in the top part. If you imagine a line right across the middle from Jupiter to Mars this is about where the horizon is. So, you could only see the bit above that line in the daytime.

The sun moves clockwise (to the right) and by night-time it will sink in the west. Now it will be dark, and you can look for some planets.

You can't see planets in the day because the sun is too bright, but they are there!



14. What planet will you see coming up in the east?

Answer Jupiter.

Hint. Try turning your paper to make the sun go down.

When will you see the moon?

Early evening as the sun goes down.

When will you see Venus?

Early in the morning before the sun comes up

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Now some maths

Each sign of the zodiac stretches anti-clockwise along the ecliptic (your inner circle) for 30 degrees.

How many degrees are there between the beginning of Leo (that's where it joins to Cancer) and the beginning of Scorpio (that's where it joins to Libra)?

Well there are 3 signs each measuring 30 degrees, that is $30+30+30 = 90$. How many degrees are there between the sun and the moon?

Yes, the same, 90 degrees.

Now you try and see what you can measure between sun and the other planets.

There is a star that never seems to move, when observed from the earth. We call this the pole star and it is in the north.

It is not on the ecliptic. It is used to navigate.

Al Biruni also measured the circumference of the earth.

He was very clever!

You can learn more about him by watching:

Youtube Science in the Golden Age - Astronomy presented by Al Jazeera.

