

## Model A

Each research team is investigating one of three possible models that may help to explain what Venus looks like from Earth as seen through a telescope.

In your model, Venus and the Sun orbit Earth in perfect circular orbits as shown in Figure 1. The Earth does not rotate. The Sun moves around the Earth once daily. Venus also travels around the Earth, but it moves slightly faster than the Sun and on a smaller orbit.

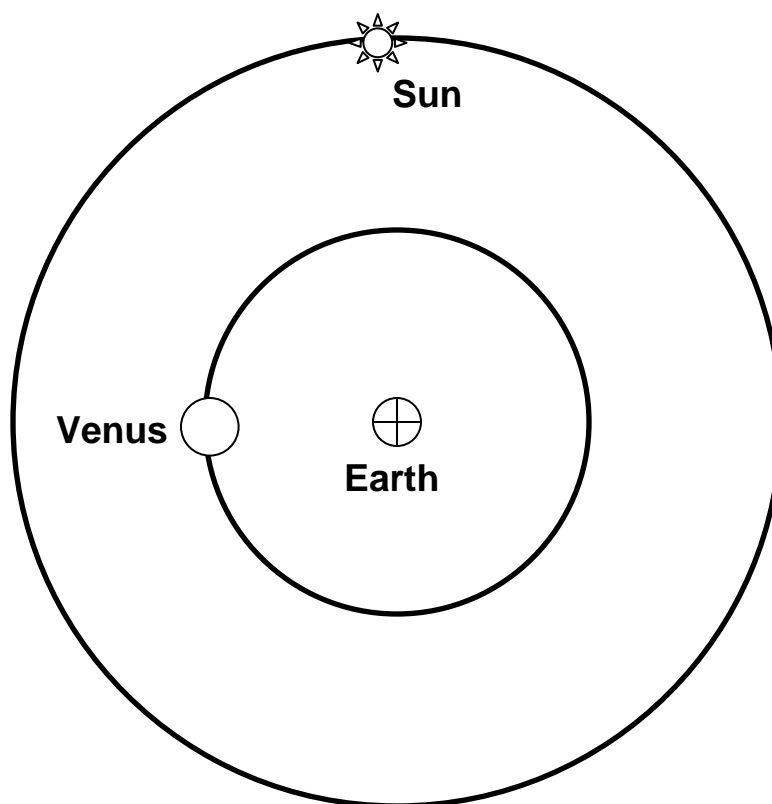
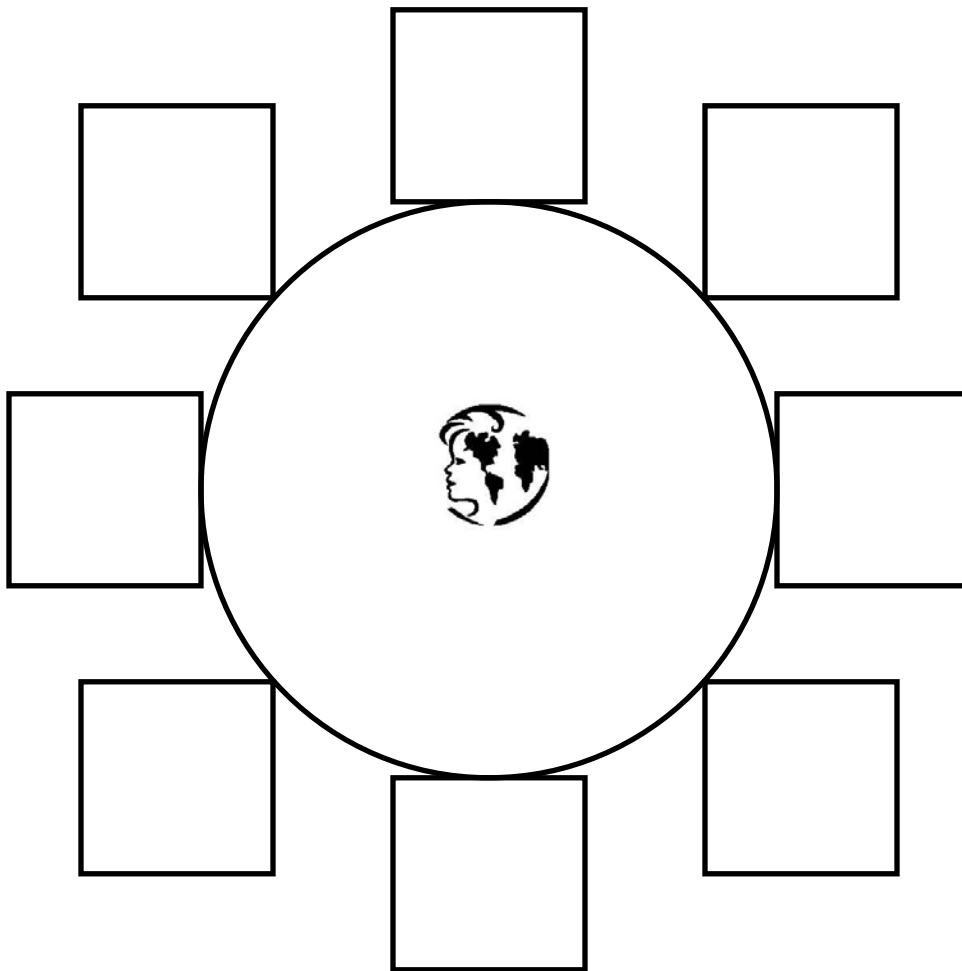


Figure 1. This is a representation of your model as seen from above.

1. Work with your team members to create a representation of your model using a light source to represent the Sun, a Styrofoam sphere to represent Venus, and use your head to represent the Earth.

2. Using your model, record your Venus phase data on page 3.

Carefully record the data produced by your model. Record both the **size and shape** of Venus. Each box represents a different Venus observation, taken several days or weeks apart. Assume that the Sun returns to the same position every 24 hours.



3. When you have finished recording the data from your model you will be given an envelope labeled Venus Pictures. This envelope contains several pictures of Venus taken with a telescope. The pictures are taken at different dates and times as indicated below each picture. Carefully compare your model with these observations.

Which aspects of the Venus observations can be explained by your model?

Which aspects of the Venus observations cannot be explained by your model?

4. Create a poster that summarizes the findings of your research team. Include your data and a summary of how well your model data matched the Venus telescope observations.

# Model B

Each research team is investigating one of three possible models that may help to explain what Venus looks like from Earth as seen through a telescope.

In your model, Venus and the Sun orbit Earth on circular orbits. The Earth does not rotate. The Sun and Venus move around the Earth once daily. As Venus moves around the Earth on a circular orbit it also moves in a smaller circle on top of this orbit (dotted line). Such a circle is called an epicycle. The **center** of Venus's epicycle moves at the same rate as the Sun.

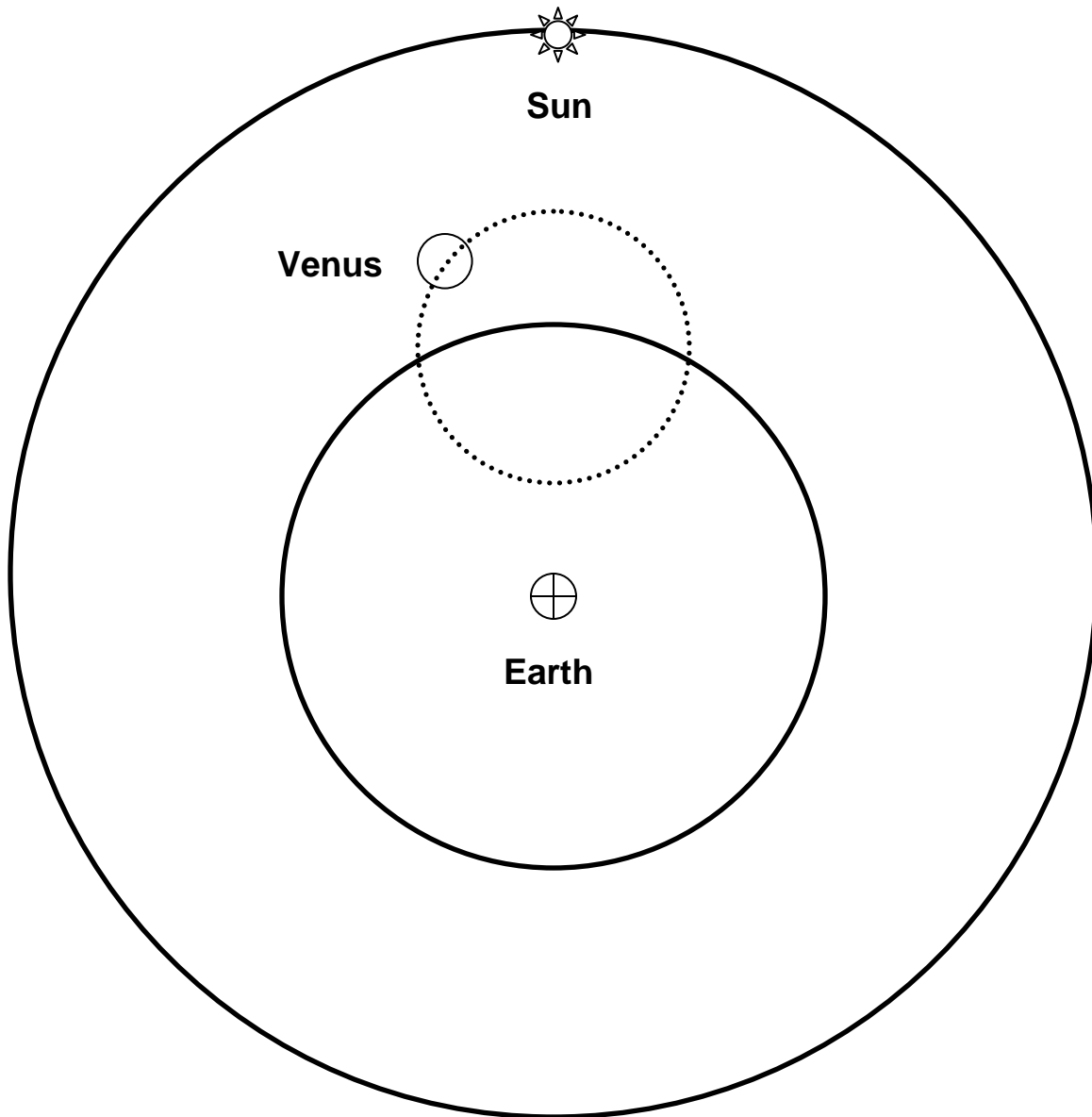
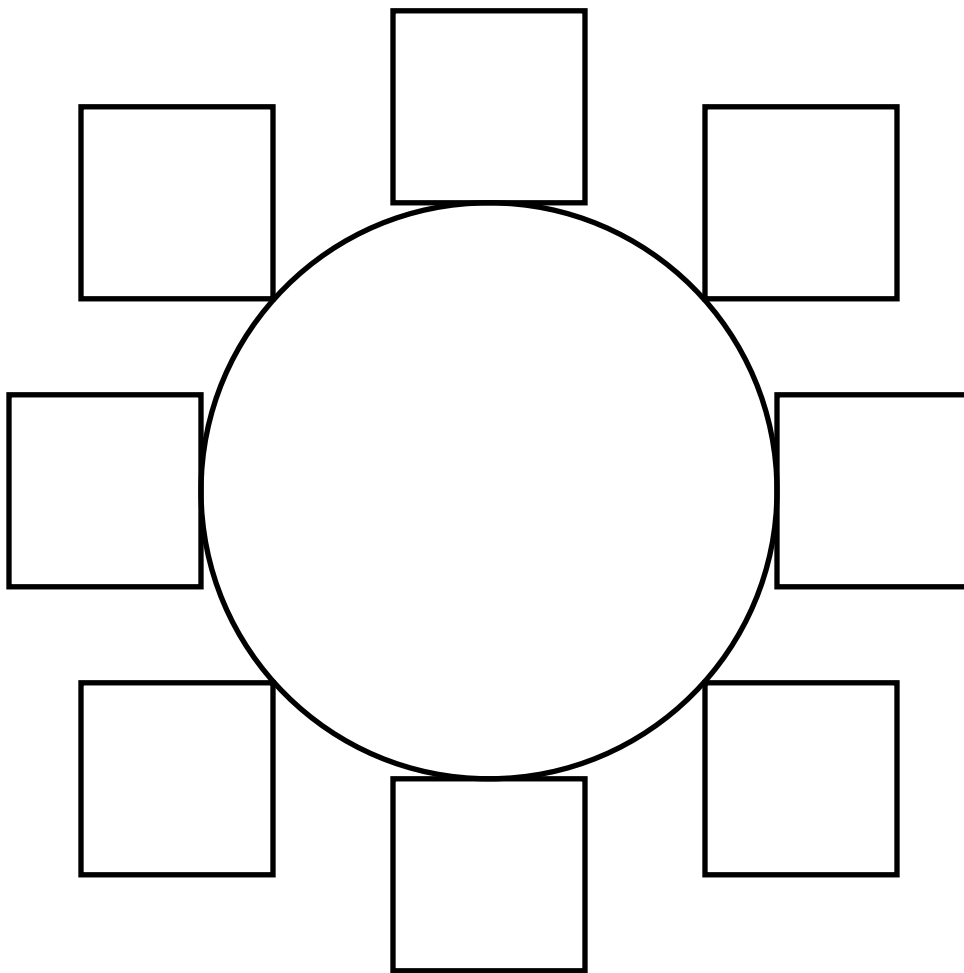


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2. Using your model, record your Venus phase data on page 3.

Carefully record the data produced by your model. Record both the **size and shape** of Venus. Each box represents a different Venus observation, during one epicycle revolution. Assume that the Sun returns to the same position every 24 hours.



3. When you have finished recording the data from your model you will be given an envelope labeled Venus Pictures. This envelope contains several pictures of Venus taken with a telescope. The pictures are taken at different dates and times as indicated below each picture. Carefully compare your model with these observations.

Which aspects of the Venus observations can be explained by your model?

Which aspects of the Venus observations cannot be explained by your model?

4. Create a poster that summarizes the findings of your research team. Include your data and a summary of how well your model data matched the Venus telescope observations.

## Model C

Each research team is investigating one of three possible models that may help to explain what Venus looks like from Earth as seen through a telescope.

In your model, Venus and Earth orbit the Sun in circular orbits, as shown in Figure 1. The Earth rotates once in 24 hours. Venus and Earth both travel around the Sun, but Venus orbits faster than Earth.

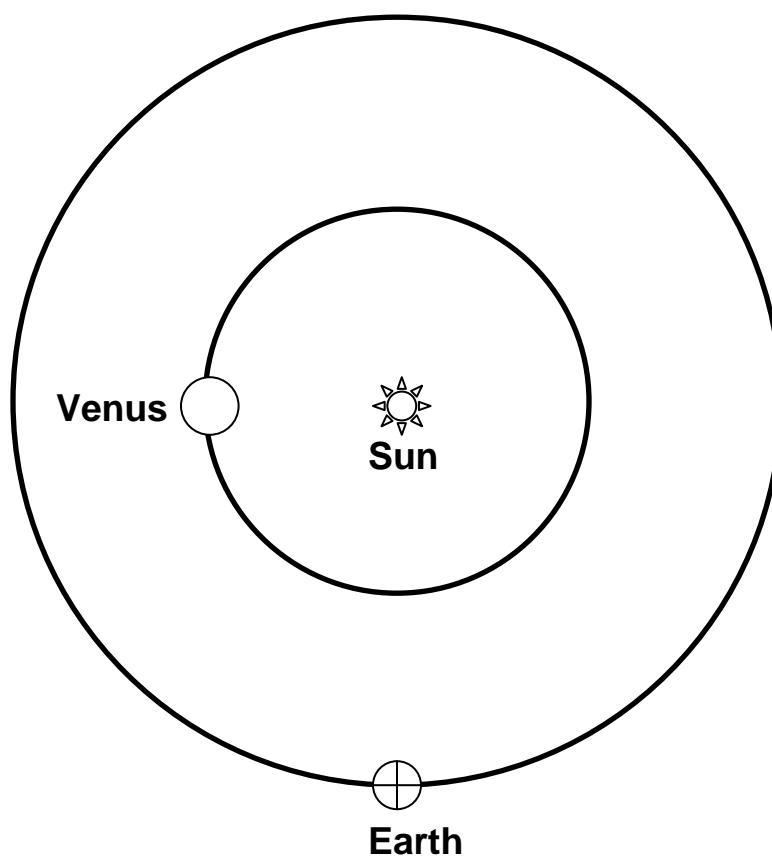
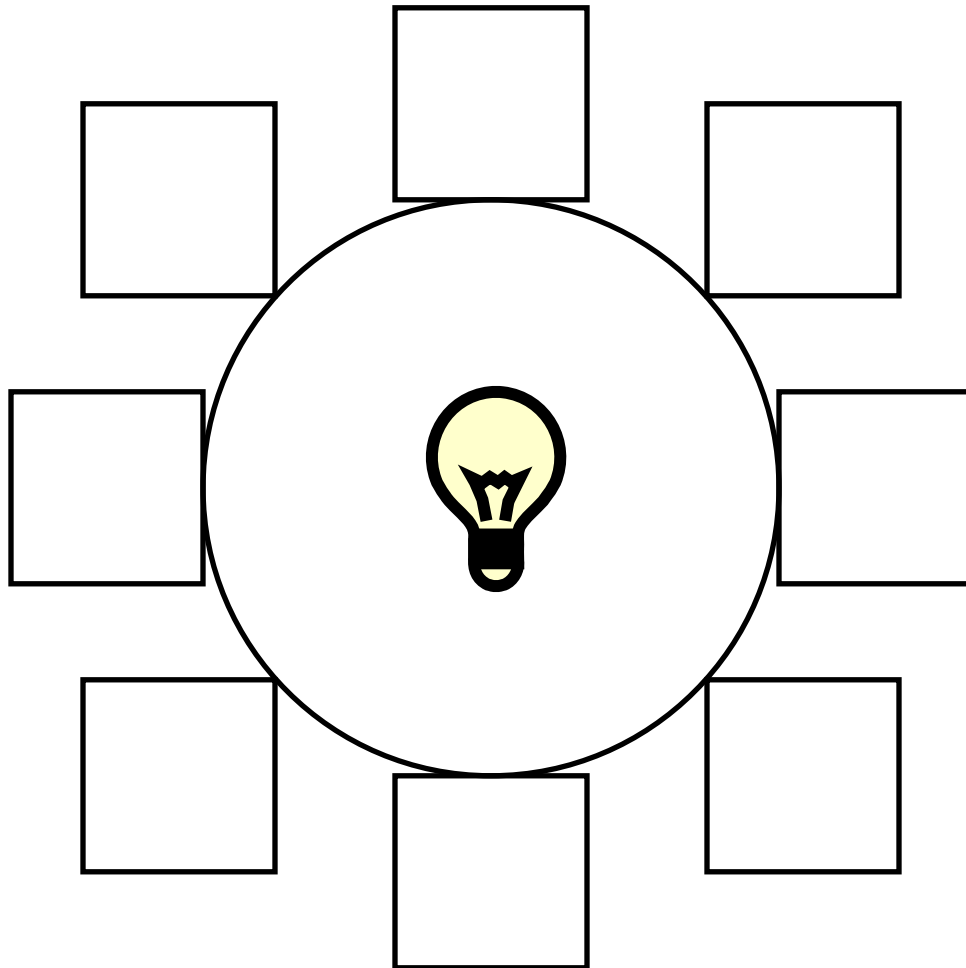


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1. Work with your team members to create a representation of your model using a light source to represent the Sun, a Styrofoam sphere to represent Venus, and use your head to represent the Earth.

2. Using your model, record your Venus phase data on page 3.

Carefully record the data produced by your model. Record both the **size and shape** of Venus. Each box represents a different Venus observation, taken several weeks or months apart.



3. When you have finished recording the data from your model you will be given an envelope labeled Venus Pictures. This envelope contains several pictures of Venus taken with a telescope. The pictures are taken at different dates and times as indicated below each picture. Carefully compare your model with these observations.

Which aspects of the Venus observations can be explained by your model?

Which aspects of the Venus observations cannot be explained by your model?

4. Create a poster that summarizes the findings of your research team. Include your data and a summary of how well your model data matched the Venus telescope observations.

## **Local Research Conference**

You are going to a Local Research Conference. At the conference there will be two other teams who have carefully studied two other models.

1. Allow each team to present their model and the results. Start with the team that investigated Model A, followed by the team that investigated Model B, and end with the team that investigated Model C.
  - Explain your model and the representation you used to gather data from your model.
  - Show the data from your model.
  - Discuss how the model data compared to the observations of Venus.
  - Present your conclusion.
2. After each Research Team has presented their observations and results, discuss as a group which model best explains the observations of Venus.
3. Prepare a brief report to a National Conference where you will share your results.

## **National Research Conference**

A representative from each Local Research Conference will make a brief presentation at the National Research Conference.

- Describe the three models you discussed.
- Present the model that your Local Conference decided best represented the observations and provide the evidence to support your claim.