



moon phases



Phases of the Moon

Grades 5-8

Prep Time: ~10 min

Lesson Time: 90 - 125 minutes



WHAT STUDENTS DO: Use a model to reprogram a “telescope” to clear photos

Students use a model to identify inaccuracies in LuCIA’s coding. They will need to successfully sequence a variety of Moon phase diagrams to “Reprogram” her code. Students will test the new code to improve the clarity of the galaxy image and reprogram her until a clear image is achieved.

NRC FRAMEWORK/NGSS CORE & COMPONENT QUESTIONS

WHAT IS THE UNIVERSE AND WHAT IS EARTH’S PLACE IN IT?

NGSS Core Question: ESS1: Earth’s Place in the Universe

What are the predictable patterns caused by Earth’s movement in the solar system?

ESS1.B: Earth and the Solar System

Instructional Objective (IO)

Students will be able to

IO1: Use a model to generate and explain the phenomenon of moon phase sequence (effect) and the arrangement/orbit of the Sun, Earth, Moon system (cause).

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1.0 Materials

Required Materials:

Please Supply:

- Computer or Laptop – 1 per student
- Supported Browsers: Chrome; Edge; Firefox; Safari

Please Print:

From Student Guide

- (A) Moon Phases Observations Recording Sheet - 1 per student
- (B) Phases Recording Sheet - 1 per student
- (C) Answers to My Questions Recording Sheet - 1 per student
- (D) Answering Open Questions - 1 per group/class
- (E) Phases of the Moon Evaluation - 1 per student

Optional Materials:

From Teacher Guide

- (F) Phases of the Moon Evaluation (KEY)
- Phases of the Moon Card Deck (GAME)

From Alignment Documents

- (N) Phases of the Moon Alignment Rubrics

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2.0 Lesson Timeline

Phases of the Moon Lesson Timeline:

Time:

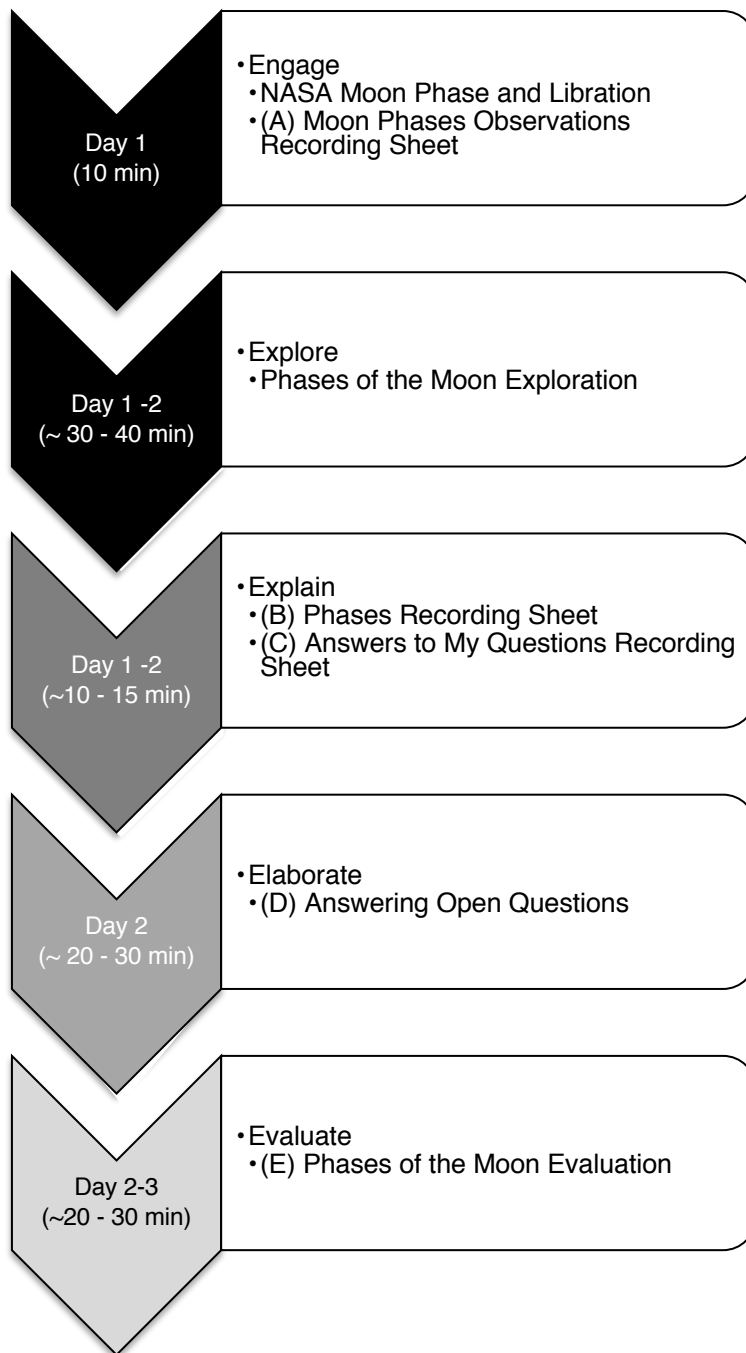
- 90 - 125 minutes

Materials:

- Student Guide pages

5-E Inquiry Process:

- The arrow color represents the 5-E step students will be primarily engaging in for that class session



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3.0 Vocabulary

coding	write code for a computer program
first quarter	the Moon has moved through one quarter of its orbit
full moon	the Moon from Earth appears to be fully illuminated
illuminated	light up
improve	brainstorm new ideas to better resolve the design problem
last quarter	the Moon has moved through three quarters of its orbit
light pollution	brightening of the night sky which inhibits the observation of stars and planets
model	representations of an idea, a process, or a system that are used to describe phenomena that we cannot experience directly
new moon	marks day 1 of the lunar cycle
problem	something to solve in engineering
prototype	early version of a design solution
research	identifying what solutions or tools already exist
test	determine if the proposed solution works
waning crescent	the view of the Moon from Earth appears crescent shaped and decreasing in illumination
waning gibbous	the view of the Moon from Earth appears to be decreasing in illumination and more than half illuminated
waxing crescent	the view of the Moon from Earth appears crescent shaped and increasing in illumination
waxing gibbous	the view of the Moon from Earth appears to be increasing in illumination and more than half illuminated

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4.0 Procedure

PRIOR KNOWLEDGE & SKILLS

- A. Rotation
- B. Revolution

PREPARATION

- A. Reserve computers or tablets for exploration days.
- B. Visit <https://infiniscope.org/lesson/phases-of-the-moon/> for access to the digital learning experience and additional resources.
- C. Enroll students in lesson if you would like to retain their progress after closing the browser window and to track their learning behavior and progress.
- D. PRINT THE FOLLOWING:
 - Student **Recording Sheets (A-C, E)** – 1 per student
 - Student **Recording Sheets (D)** – 1 per group or class

STEP 1: ENGAGE (~10 minutes)

Moon Phases Phenomena

- 🍏 **Fun Tip:** Since the students will be experiencing an 80's theme during the Phases of the Moon experience, why not have fun with it! Have a Moon and/or 80's themed party to set the tone! Food, beverages, decorations, nametags with Moon Phase names, go all out! [Send us your Phases of the Moon photos!](#)
- A. Prior to starting the digital lesson *Phases of the Moon*, hand out **(A) Moon Phases Observations Recording Sheet** and have students answer the questions to record their observations and questions regarding Moon phases. Use the animations of Moon phases on [Moon Phase and Libration](#) site hosted by the NASA Scientific Visualization Studio. Choose any of the first four assets on the page to complete the task. Anything below the heading of the "Moon's Orbit" is not recommended until the conclusion of the activity.
- B. Possible narrative you can use to engage the students in the experience:

*You've documented some great questions so far! You are about to explore Phases of the Moon and meet a character named LuCIA who will be your guide through the learning experience. As you complete the experience, many of your questions will be answered. As you learn the answers to your questions, you will add the answer to **(C) Answers to My Questions Recording Sheet**. Don't worry if all your questions are not answered. We will answer the rest of your questions at the end of the experience.*

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- C. Hand out or assign individual computers and ask students to access the *Phases of the Moon* lesson linked above. If you have enrolled your students, your students will access your class or lesson via enrollment feature instead.

STEP 2: EXPLORE (~ 30 - 40 minutes)

Phases of the Moon Space Exploration

- A. Students will complete their exploration of the Moon phases through the web browser, alternating between EXPLORE and EXPLAIN activities.
- 🍏 **Teacher Tip:** If students seem to be stuck in an activity, it isn't responding in a way that seems correct, or if an error occurs, students can attempt to refresh their browser or click the hamburger button (three horizontal lines) in the upper right corner, then choose "Restart Lesson." "Restart Lesson" will clear all of their progress and bring them back to the start screen. Hitting the browser's "Refresh" button will not restart the activity.
- 🍏 **Teacher Tip:** If you would like to analyze student interactions in this activity, you can sign up to join the [Infiniscope Teaching Network](#) and enroll your class into the activity. By enrolling, you will gain access to the analytics of the activity by student to see how students progressed through the activity. You also have the ability to adopt the activity and adapt it to the specific needs of your classroom, school, or community.

STEP 3: EXPLAIN (~ 10 - 15 minutes)

Phase Questions Answered

- A. Hand out **(B) Phases Recording Sheet and (C) Answers to My Questions Recording Sheet**. Students will complete these recording sheets as they work through *Phases of the Moon* learning experience. The goal is to keep running documentation as they explore.
- 🍏 **Teacher Tip:** Because this learning experience is more intensely focused on why Moon phases occur as opposed to the naming conventions and days, it is highly recommended that a follow up be completed with students if the district or school standard requires students can articulate the name of these phases.

STEP 4: ELABORATE (~ 20 - 30 minutes)

Revisiting Questions

- A. Before handing out the final evaluation sheet, present students with **(D) Answering Open Questions**. This sheet provides resources to answer their questions possibly not addressed from **(B) Answers to My Questions Recording Sheet**. This sheet could also be used as an extension.

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STEP 5: EVALUATE (~ 20 - 30 minutes)

Evaluate Phases of the Moon

A. Option 1: If you have chosen to enroll students in the lesson, you can find individual summative assessments under the *Answers Report* within your Class in the Smart Sparrow workspace.

B. To assess their knowledge on illumination, look for screen names:

LO1b: Illumination, LO1b: Illumination Portion, LO1b: Illumination Pattern

C. To assess their knowledge of the arrangement, look for screen names:

LO1c: Level 3 New Moon – Level 3 Waning Crescent

D. To assess their knowledge of the sequence, look for screen name:

IO1: Level 5 Sorting

E. To assess their explanation, look for screen names:

IO1: FITB1 and IO1: FITB2

F. Option 2: Hand out **(E) Phases of the Moon Evaluation** for student to complete. They will generate drawings and explanations of their understanding of a particular Moon Phase. You will need to assign each student a moon phase name, but it cannot be full moon.

🍏 Differentiation Tip: Assign struggling students New Moon, First or Last Quarter. All other students can be assigned any combination of waxing/waning and crescent/gibbous.

5.0 Evaluation/Assessment

Use the *(N) Phases of the Moon Rubric* as a summative assessment, providing final assessment of the learning activities. The rubrics evaluate the activities using the Next Generation Science Standards and NRC Framework.

6.0 Extensions

1. Print the *Phases of the Moon* card set. Cut and laminate the cards then use to play any of the following games:
 - Rummy
 - Go Fish
 - Memory

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PHASES OF THE MOON

Student Guide

(A) Moon Phases Observations Recording Sheet

Name: _____

Watch the NASA animations shown by your teacher to complete the following:

1. Draw and label the position of Earth, Moon, and Sun that you think causes Moon phases to occur.

A large, empty rectangular box with a thin black border, intended for a student to draw and label the positions of Earth, the Moon, and the Sun to explain the causes of moon phases.

2. What questions do you have about Moon phases?

- _____

- _____

- _____

- _____

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PHASES OF THE MOON

Student Guide

(B) Phases Recording Sheet

Name: _____

Complete the chart by drawing an example of the Moon phase that matches the phase name listed and day(s) the phase occurs.

Phase Drawing	Phase Name	Day of Phase
	New Moon	1
	Waxing Crescent	2-6
	First Quarter	7
	Waxing Gibbous	8-13
	Full Moon	14
	Waning Gibbous	15-20
	Third Quarter	21
	Waning Crescent	22-28

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**(C) Answers to My Questions Recording Sheet**

Name: _____

As you work through the experience record the answers to your questions below.

Write your answered question from (A) Moon Phases Observations Recording Sheet	What is the answer to your question

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PHASES OF THE MOON

Student Guide

(D) Answering Open Questions.

<https://spaceplace.nasa.gov/dr-marc-moon-phases/en/>

- How long does each moon phase last?

<https://planetarium.madison.k12.wi.us/mooncal/moonfaq.htm#1>

- Does the moon rotate on an axis like the earth?
- Does the moon have day and night?
- Why isn't the moon visible every night (or every day)? (see also #19)
- Are the phases different in the northern and southern hemispheres?
- Why don't the phases of the moon happen on the same day each month?
- So exactly how long does it take the moon to orbit the Earth?
- If I observe the moon at noon, and then again that evening, would the phase be the same?
- What causes the moon to shine?
- Wouldn't the earth block the light from the sun to the moon?
- Could light from the sun bounce off the earth and hit the moon?
- Is there a cute way to remember the phase terms? I am always mixing up waxing and waning. Also some people say "no moon" for new moon.
- Would the earth appear to go through phases for an observer on the moon?
- Does the moon rise and set at the same time each day?
- Why isn't the quarter moon called a half moon?
- If we are seeing a full moon here in the United States, would people in India see the full moon?
- Why does the Harvest Moon look orange when it rises?
- Do the times on the day-time moon calendar apply to my time zone?
- If we were at the North Pole, when would we see the moon?
- Which phases of the moon can we see during the day? (see also #3)
- Does the moon have a North Pole?
- Why is the crescent moon at sunset sometimes tilted like a backwards "C", and sometimes flat on its back like a "U"?

<https://spaceplace.nasa.gov/all-about-the-moon/en/>

- Other questions

<https://moon.nasa.gov/about/misconceptions/>

- Misconceptions

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**(E) Phases of the Moon Evaluation (1 of 4)**

Name: _____

1. Explain the role of the Sun in the phases of the Moon.

2. Draw a diagram with labels below to support your explanation.

A large, empty rectangular box with a thin black border, intended for a student to draw a diagram illustrating the role of the Sun in the phases of the Moon.



PHASES OF THE MOON

Student Guide

(E) Phases of the Moon Evaluation (2 of 4)

Name: _____

3. Explain the role of the position of the Moon in the phases we see on Earth.

4. Draw a diagram with labels below to support your explanation.

A large, empty rectangular box with a thin black border, intended for a student to draw a diagram illustrating the Moon's phases.

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PHASES OF THE MOON

Student Guide

(E) Phases of the Moon Evaluation (3 of 4)

Name: _____

5. What Moon phase have you been assigned?

6. In Box A on the right, draw a picture of your Moon phase as viewed from Earth.

7. What day or days (between 1 – 28) does your Moon phase usually occur?

8. In Box B on the right, draw a picture of the Moon phase that would follow your Moon assigned phase.

9. In the Box C below, draw Earth and the Moon in the correct arrangement to create the Moon phase you were assigned. Remember to include labels and shading to show light and dark sides.

Box A**Box B****Box C**

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PHASES OF THE MOON

Student Guide

(E) Phases of the Moon Evaluation (4 of 4)

Name: _____

Describe the **cause and effect relationship** responsible for Moon phases by completing the following sentences using the word banks at the right.

10. The phases of the Moon are a _____
phenomenon visible from _____
with a repeating pattern.

the Moon
natural
Earth
the Sun
human-made

11. Phases of the Moon are caused by the position of
_____ and the portion of the
Moon illuminated by _____ that
can be viewed from _____.

Earth
the Moon in its orbit
the Sun
Earth in its orbit
the Sun in its orbit

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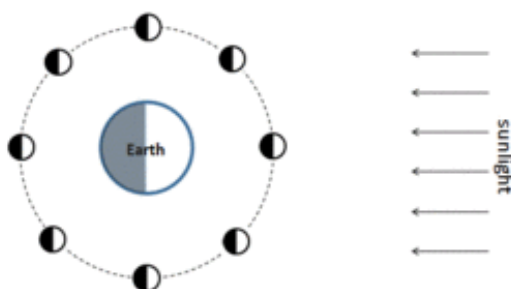
Student Guide

(F) Phases of the Moon Evaluation (KEY 1 of 4)

1. Explain the role of the Sun in the phases of the Moon.

Half of the Moon is always lit from the Sun's light reflecting off the Moon. The side of the Moon facing the Sun is always illuminated, but the Moon moves around Earth in orbit, so our view from Earth changes, which are the phases of the Moon.

2. Draw a diagram with labels below to support your explanation.



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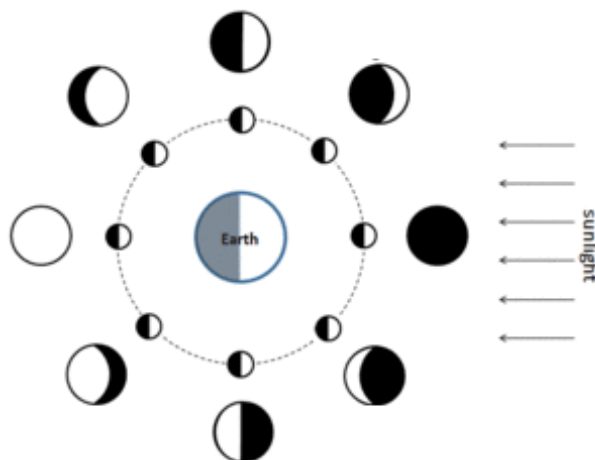
(F) Phases of the Moon Evaluation (KEY 2 of 4)

Name: _____

3. Explain the role of the position of the Moon in the phases we see on Earth.

The Moon takes 28 days to orbit Earth. This means we are seeing the Moon illuminated in different patterns because we know the Sun is always shining and half of the Moon is illuminated at all times.

4. Draw a diagram with labels below to support your explanation.



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PHASES OF THE MOON

Teacher Guide

(F) Phases of the Moon Evaluation (KEY 4 of 4)

Describe the ***cause and effect relationship*** responsible for Moon Phase by completing the following sentences using the word banks at the right.

10. The phases of the Moon are a natural phenomenon visible from Earth with a repeating pattern.

the Moon
natural
Earth
the Sun
human-made

11. Phases of the Moon are caused by the position of the Moon in its orbit and the portion of the Moon illuminated by the Sun that can be viewed from Earth.

Earth
the Moon in its orbit
the Sun
Earth in its orbit
the Sun in its orbit

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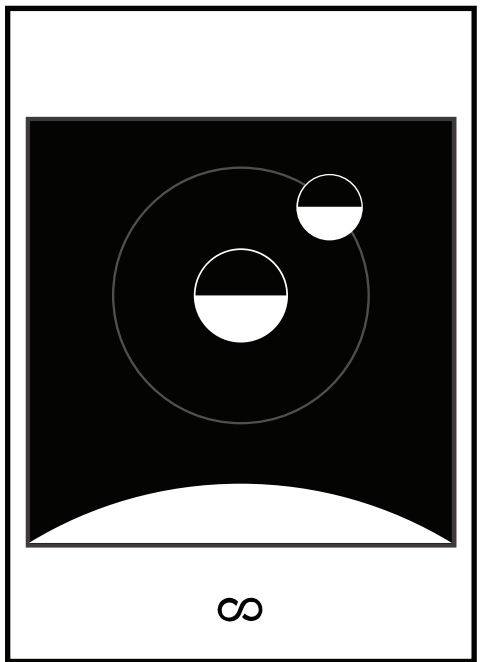
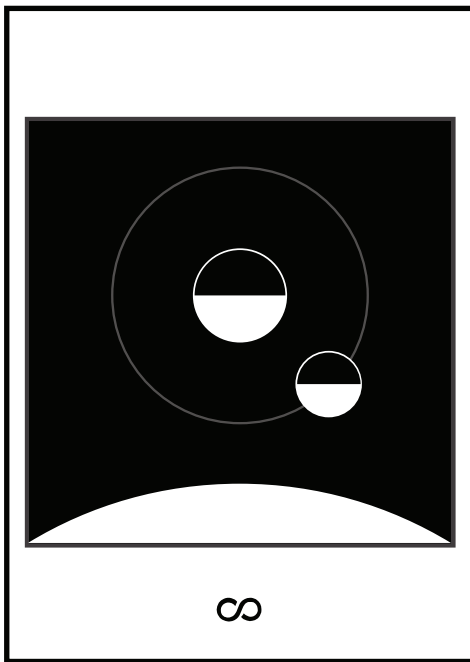
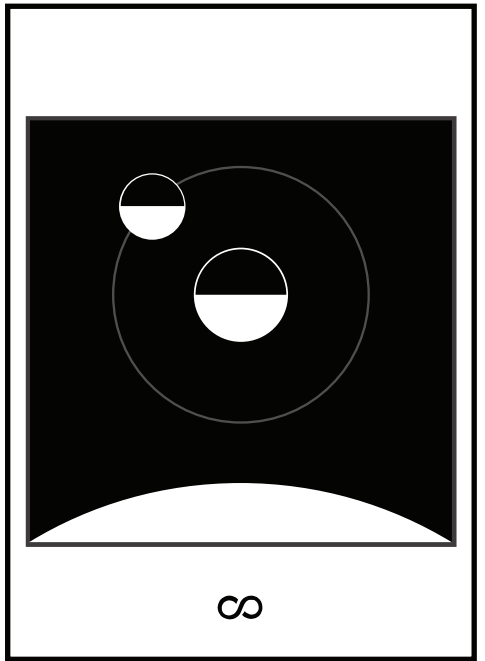
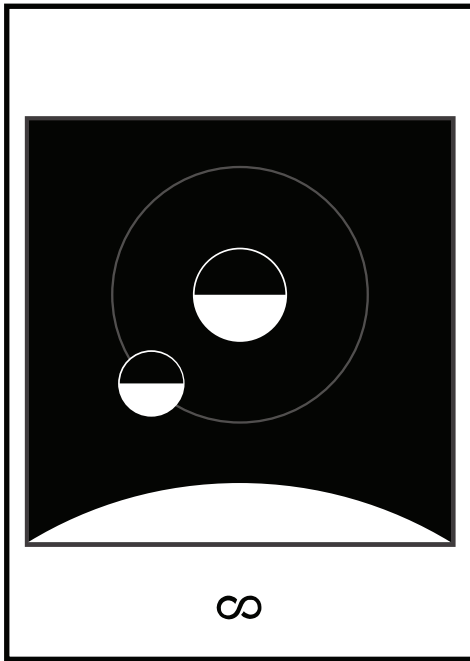
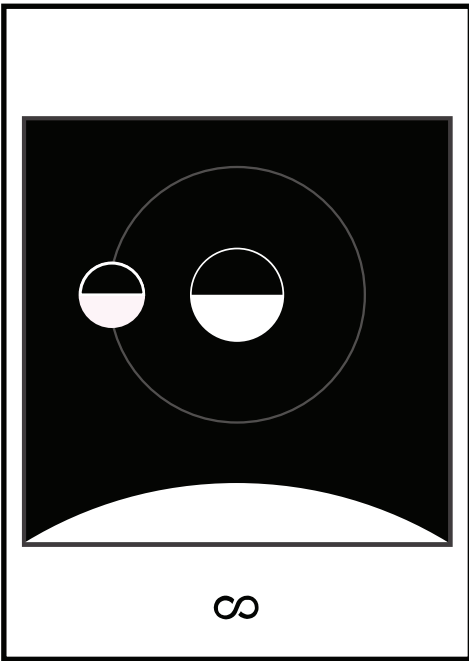
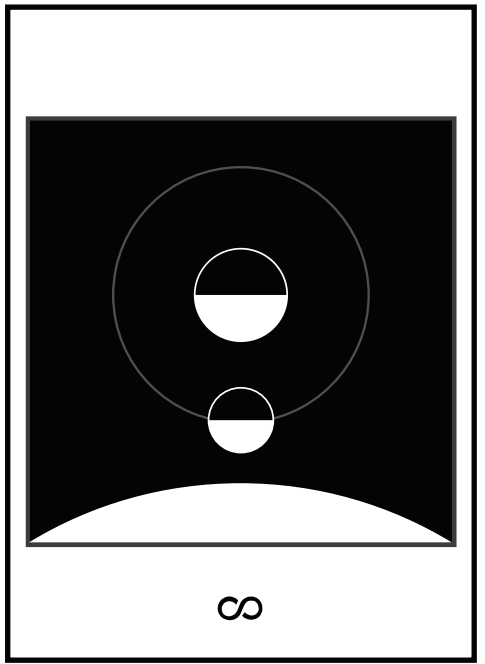
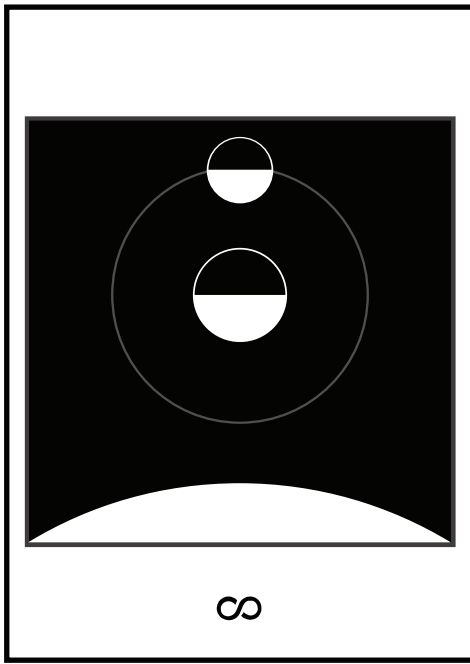
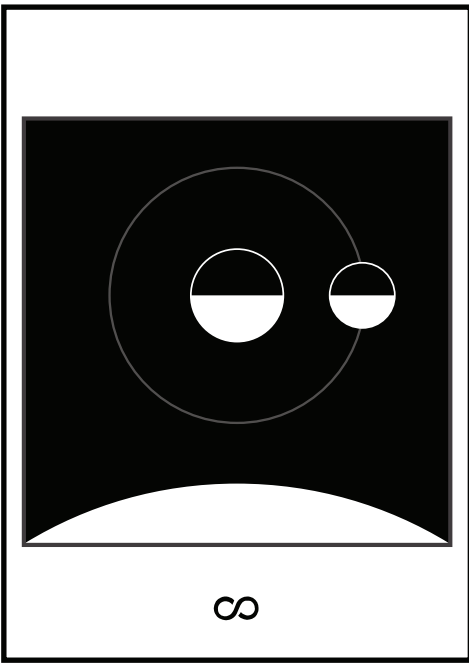
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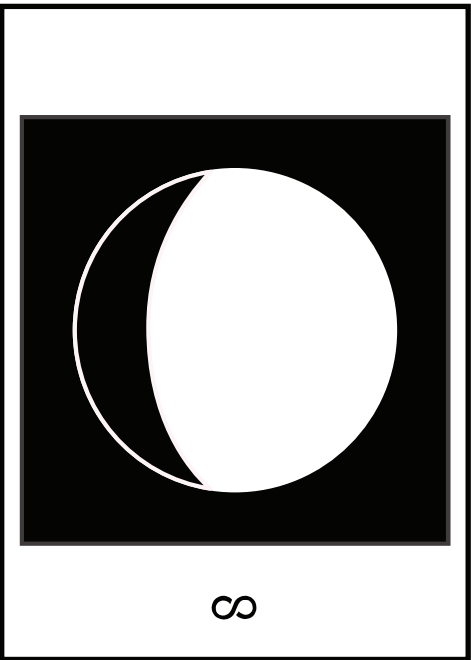
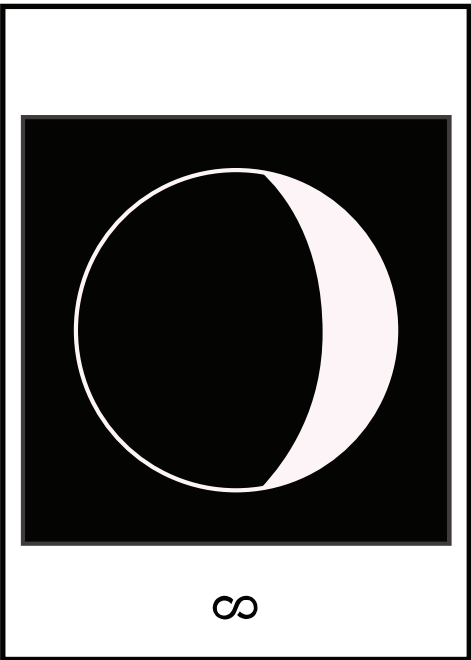
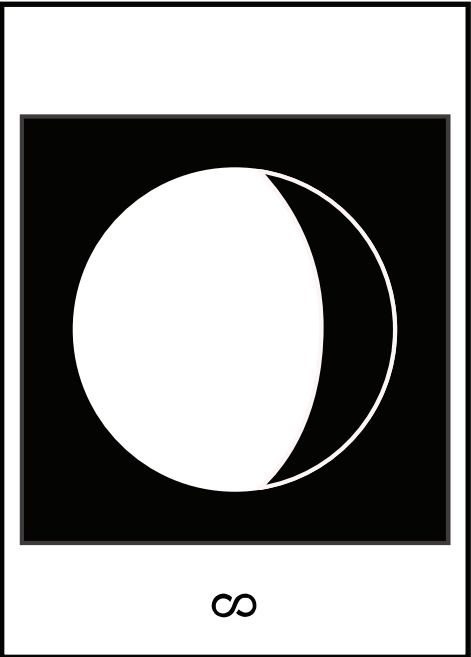
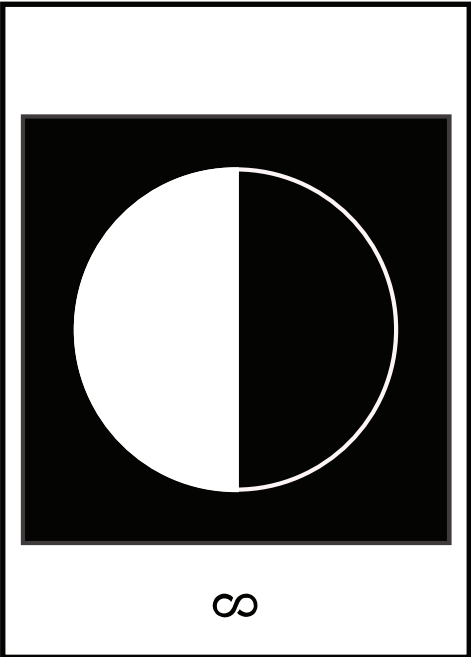
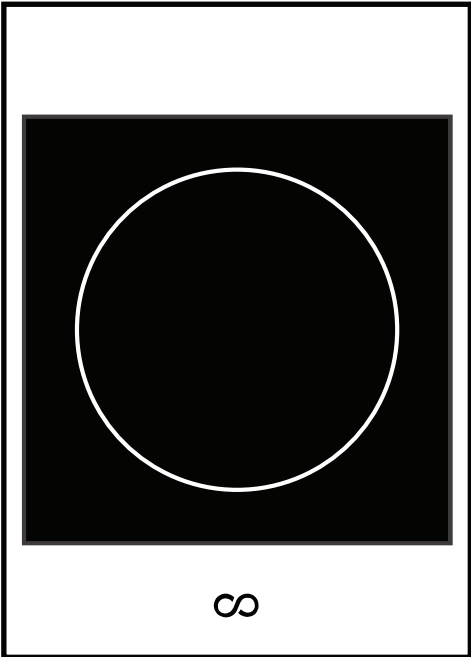
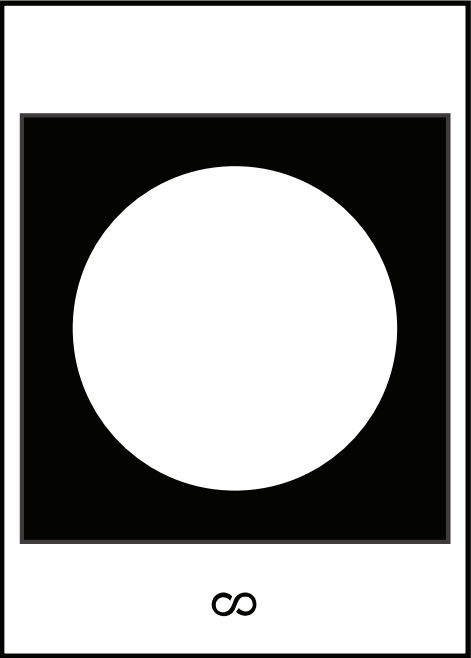
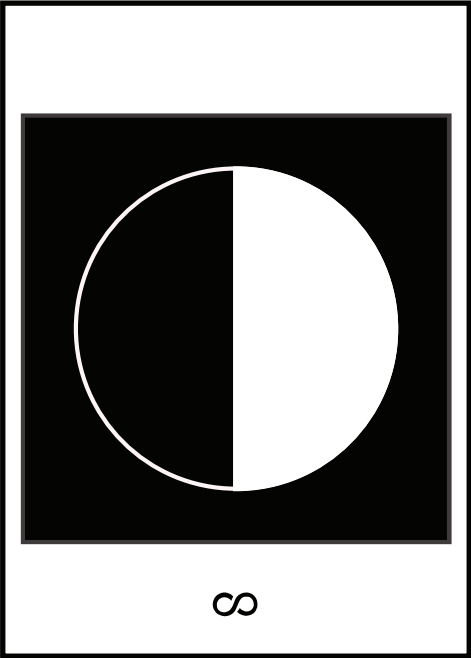
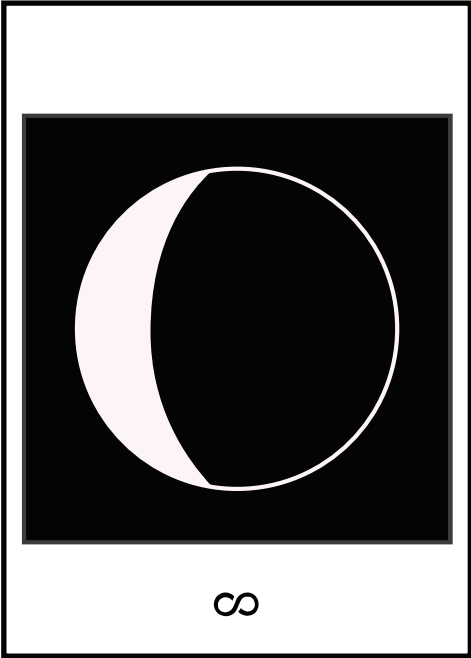
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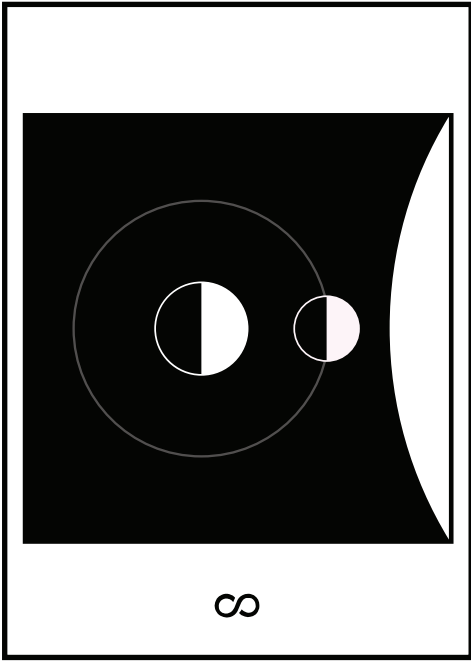
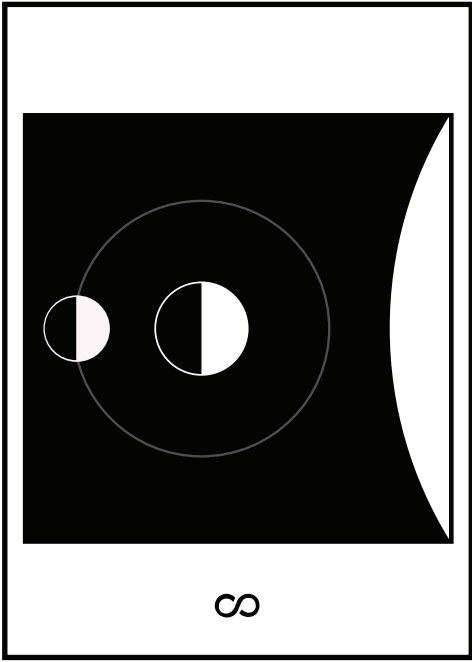
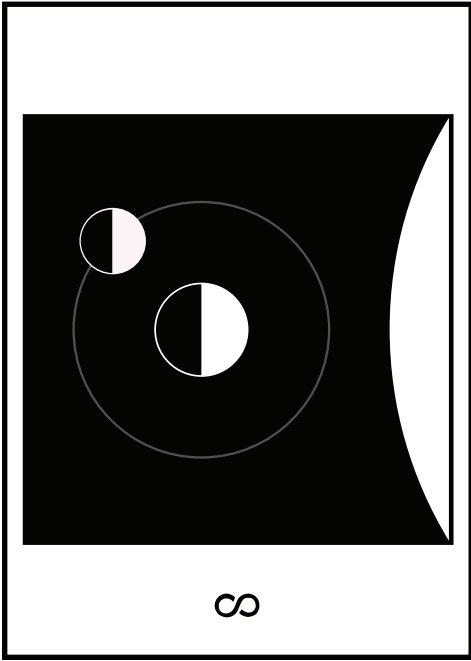
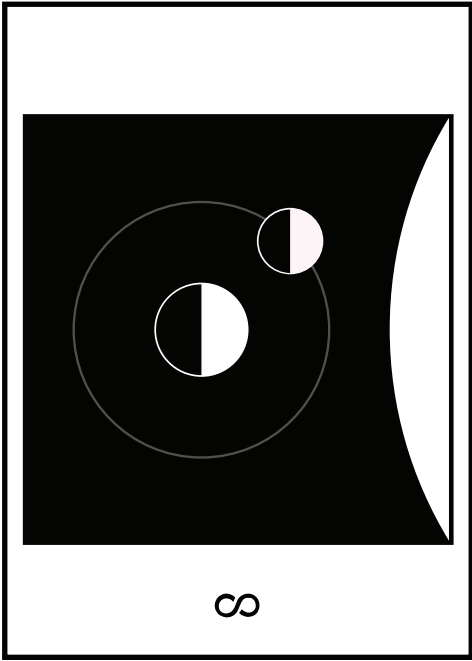
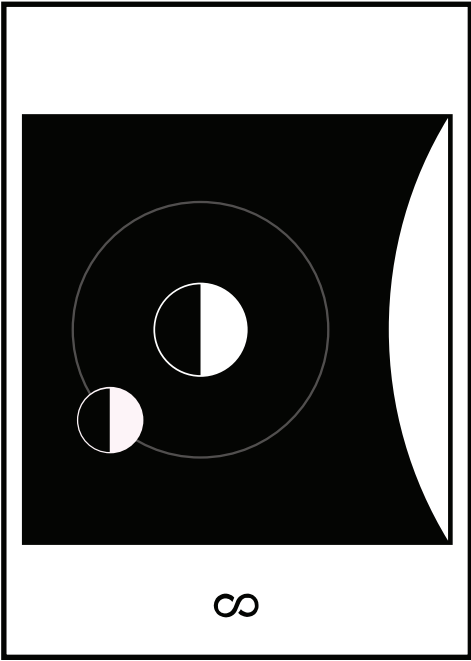
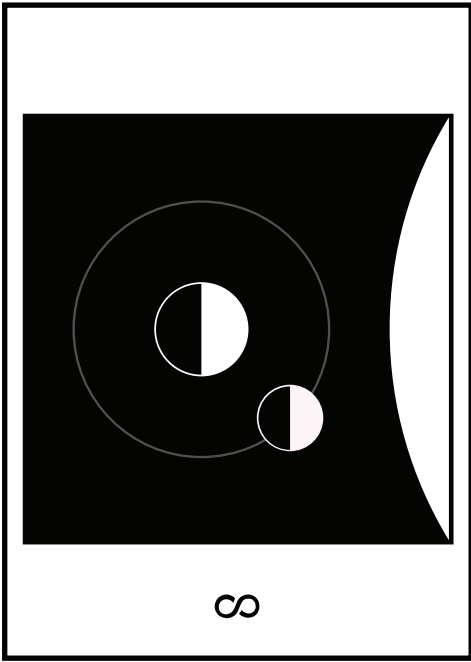
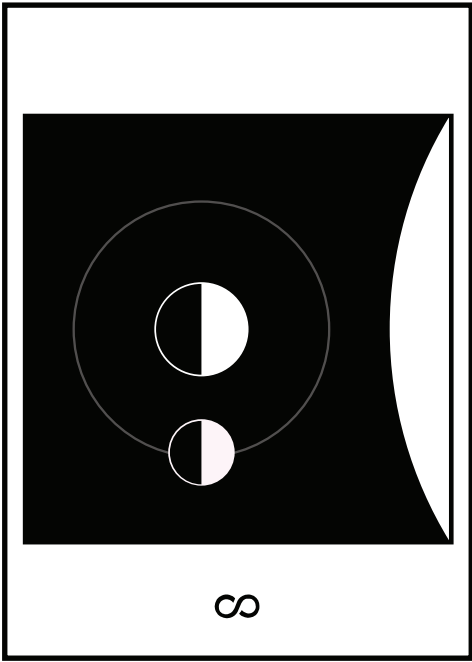
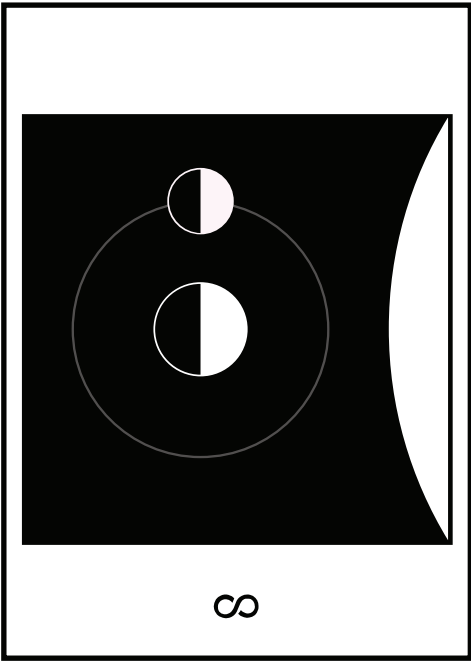
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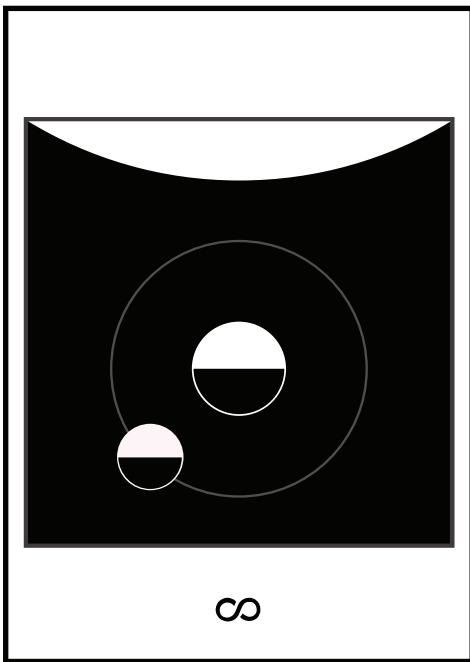
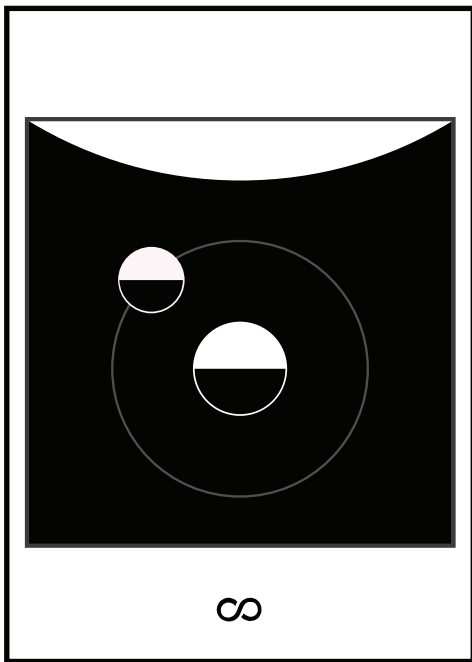
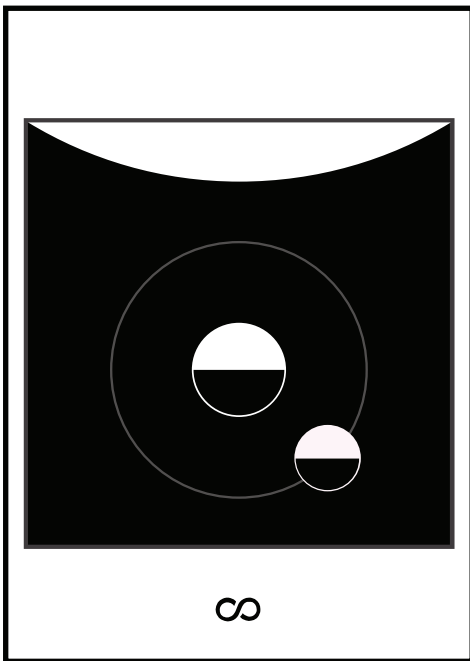
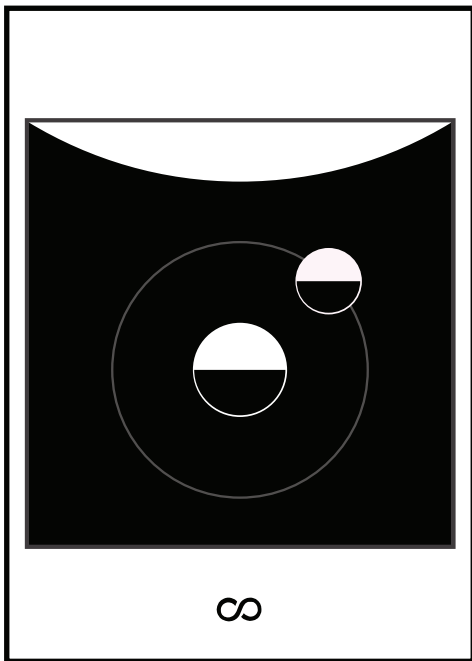
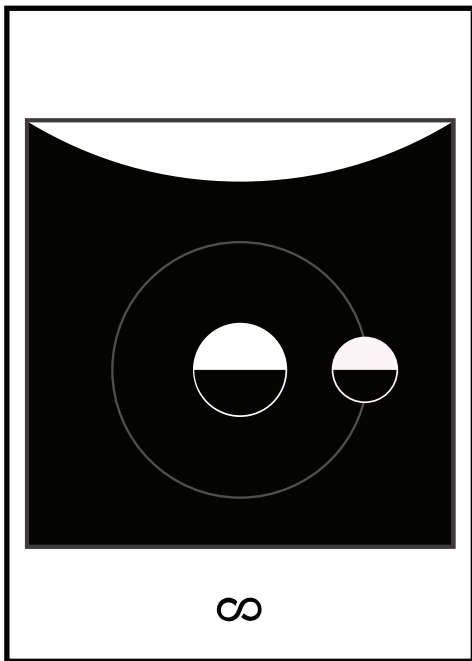
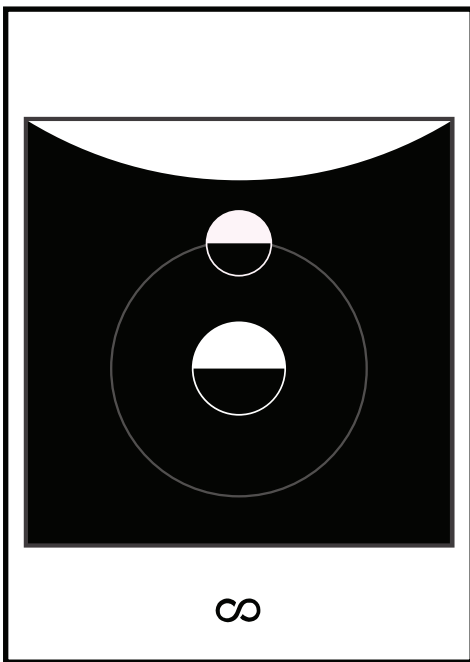
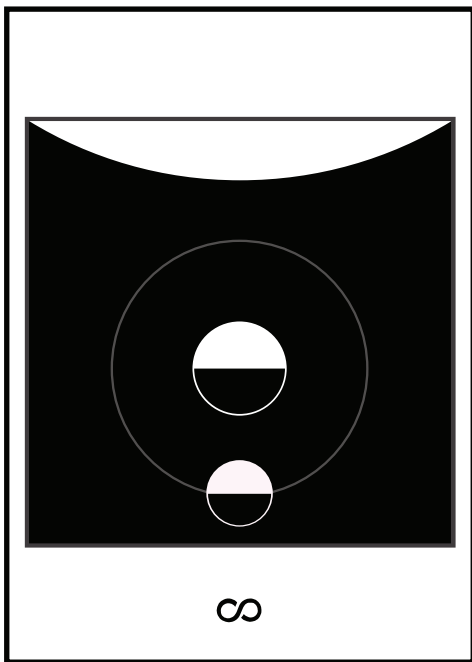
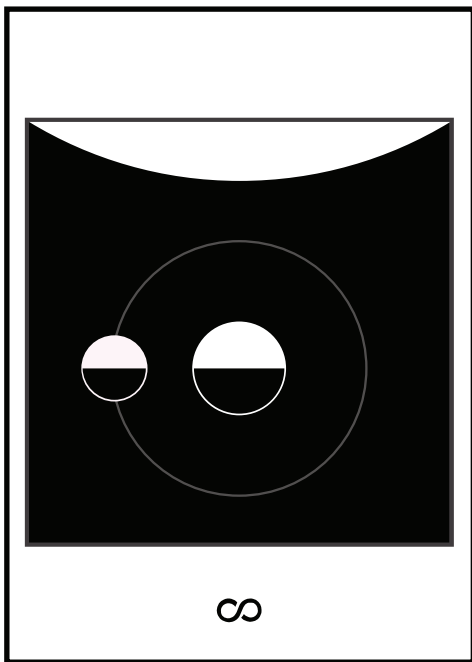
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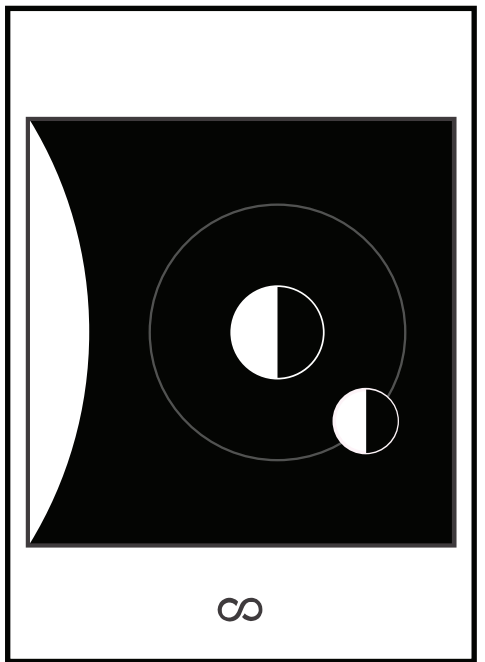
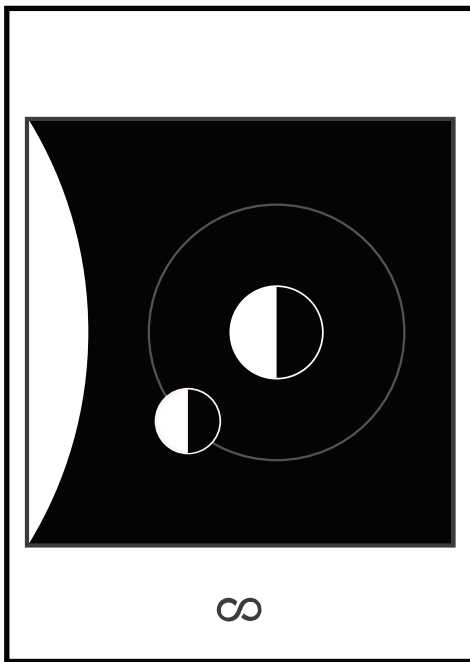
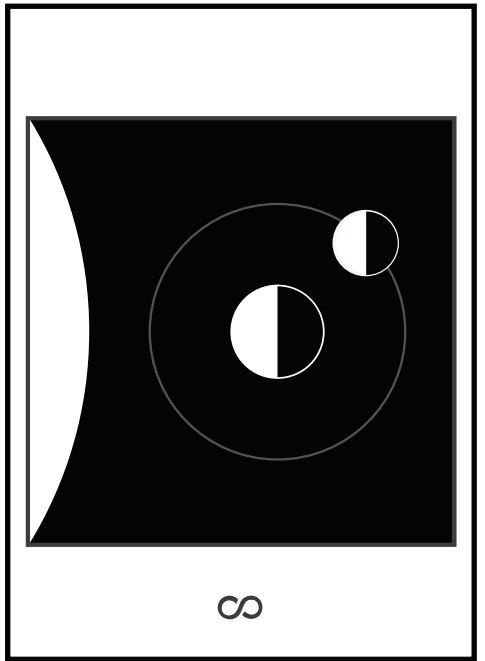
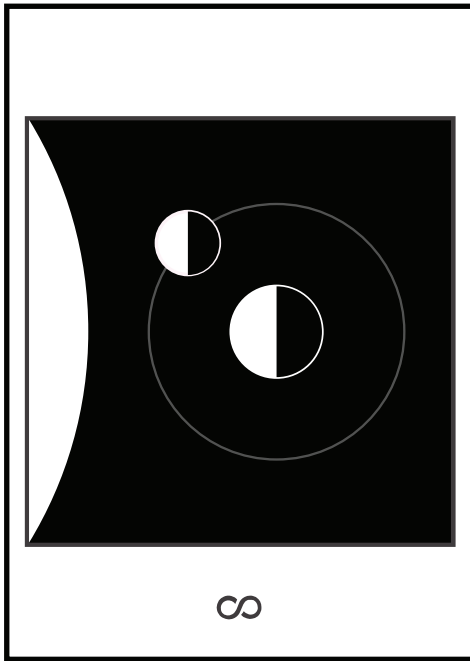
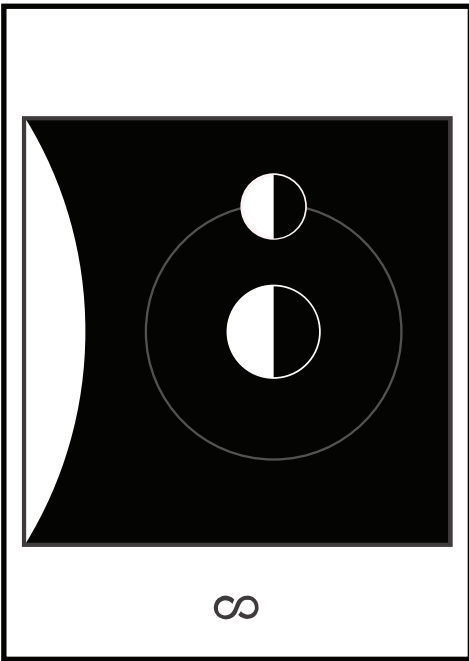
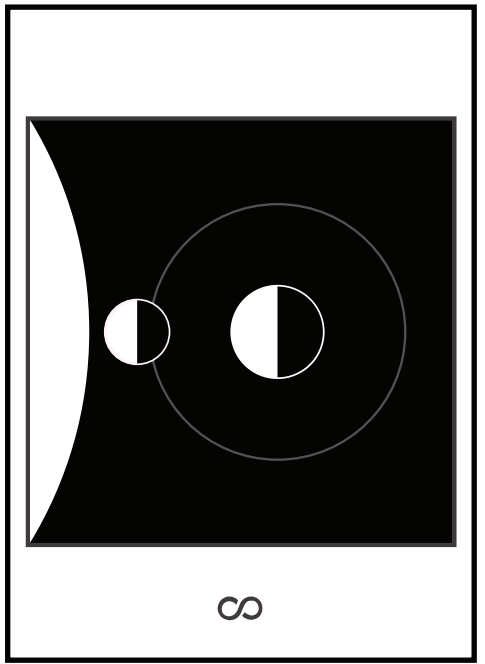
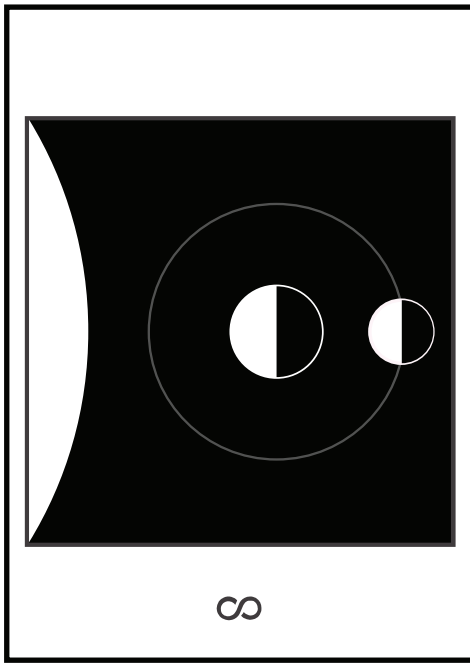
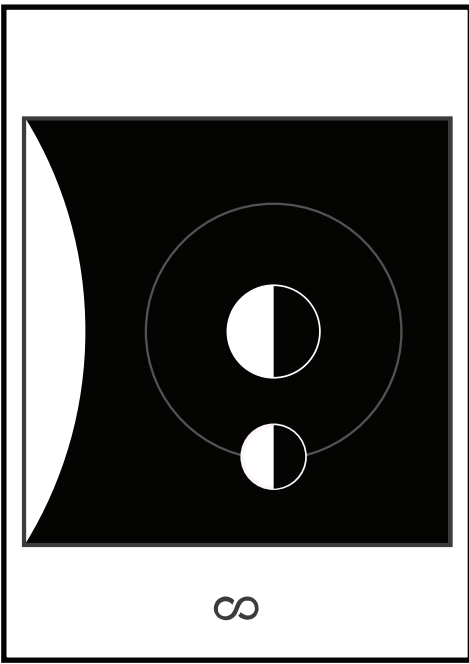
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First
Quarter

∞

Full
Moon

∞

New
Moon

∞

Third
Quarter

∞

Waning
Crescent

∞

Waning
Gibbous

∞

Waxing
Crescent

∞

Waxing
Gibbous

∞