ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL ONE

INSTRUCTIONAL GUIDE

SECTION 3

EO C140.02 – DISCUSS SLEEP PATTERNS IN SPACE

Total Time: 60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-801/PG-001 *Proficiency Level One Qualification Standard and Plan*, Chapter 4. Specific uses for said resources are identified throughout the instructional guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

The activities in this lesson take place over a two week period.

Photocopy the Reaction Time Sheet located at Attachment A, two copies for each cadet.

Photocopy the Multiple Rulers Sheet located at Attachment B and cut into individual rulers for each cadet.

Photocopy the Sleep Log Sheet located at Attachment C for each cadet.

Photocopy the Fraction Wheel for 24 Hours located at Attachment D for each cadet.

Photocopy the Fraction Wheel for One Complete Day located at Attachment E for each cadet (copy onto a sheet coloured differently from Attachment D).

PRE-LESSON ASSIGNMENT

Nil.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to the problems astronauts face sleeping in space.

An in-class activity was chosen for TPs 2 and 3 to allow the cadets to experience some of the factors facing astronauts sleeping in space.

INTRODUCTION

REVIEW

Nil.

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OBJECTIVES

By the end of this lesson the cadet shall have discussed sleep patterns in space.

IMPORTANCE

This lesson will introduce the cadets to sleep patterns and how stressors affect astronauts sleeping in space.

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Teaching point 1 **Explain sleep patterns in space.**

Time: 10 min Method: Interactive Lecture

SLEEP PATTERNS

Sleep for humans is a recurring state that is characterized by a lack of consciousness, lack of sensory activity and all voluntary muscles are inactive. It is not the same as resting, and awakening is possible, unlike hibernation or a coma. It is also a time that the body rejuvenates its immune, nervous, skeletal and muscular systems.

Sleep has a major impact on overall quality of life and affects how a person looks, feels and performs on a daily basis.

The Effects of Lack of Sleep

Lack of sleep may cause fatigue, daytime sleepiness, clumsiness, weight loss or weight gain and most importantly, deficits in attention and working memory. This can lead to errors in daily routine that can range from forgetting an ingredient while preparing a meal to falling asleep while driving.

For sleep to be effective, the length and soundness of the sleep are critical. To rejuvenate the body, a teenager needs at least 8½ hours, and on average 9¼ hours, a night of uninterrupted sleep. If sleep is interrupted, there is not enough time for the body to complete all of the phases needed for muscle repair, memory consolidation and release of hormones regulating growth and appetite. This affects concentration, decision making, and impedes the ability to participate successfully in school and social activities.

Types of Sleep

Sleep follows a pattern of alternating between REM (rapid eye movement) and NREM (non-rapid eye movement) sleep throughout a typical night in a 90-minute cycle that repeats itself.

NREM sleep takes place during three quarters of the sleep period and is the first step in falling asleep. NREM sleep is the body preparing for REM sleep and in its final stages it starts the body’s restoration process. During NREM sleep, the body stabilizes and lowers blood pressure, breathing slows, temperature drops, muscles relax, and hormones are released that are essential for growth and development.

REM sleep takes place approximately 90 minutes after falling asleep and recurs every 90 minutes, getting longer later in the night. It provides energy to the brain, induces rapid eye movement and turns off voluntary muscles. It is the dream state.

Astronauts must sleep while on missions in space, but the excitement of a space mission, the inevitable motion sickness and a zero gravity environment can play havoc with an astronaut's sleep patterns. Without the effects of gravity, an astronaut can sleep in any position as long as they do not move around. Tossing and turning would send an unrestrained astronaut careening all around the cabin.

Astronauts aboard the space station use sleeping bags to restrain their movement when they need to sleep. The sleeping bags are attached to the walls of the space station. Sleep stations are spread throughout the space station.

Due to the cramped living conditions in space, the astronauts are packed into a small area where they can hear each other. Snoring has been documented on one of the missions when a medical doctor was wired to record his sleep patterns.

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A circadian rhythm is a daily cycle of biological activity based on a 24-hour period and influenced by regular variations in the environment, such as the alternation of night and day. Circadian rhythms include sleeping and waking in animals, flower closing and opening in angiosperms, and tissue growth and differentiation in fungi.

We are accustomed to the circadian rhythms here on earth with the 24 hour day and night cycle. The International Space Station (ISS) orbits the Earth every 90 minutes so the sun setting cannot be used as an indicator of when to sleep. Astronauts can use a sleep blindfold, but may still be disturbed by the artificial light where they are sleeping. To overcome all of the problems of sleeping in space, astronauts may use sleeping pills to ensure they get an appropriate amount of sleep.

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Note: From CSA (2011). CSA Astronaut Robert Thirsk Sleeping in the Japanese Module of the ISS. Retrieved December 7, 2011 from http://www.asc-csa.gc.ca/eng/astronauts/living_sleeping.asp

Figure 1 CSA Astronaut Robert Thirsk sleeping in the Japanese module of the ISS

The astronauts are scheduled for an 8 hour sleep period when each mission "day" comes to an end. The waking and sleeping cycle is an artificial substitute for the day night cycle on earth

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Teaching point 2 **Have the cadets participate in an activity where they measure their current state of alertness.**

Time: 15 min Method: In-Class Activity

ACTIVITY

Time: 15 min

OBJECTIVE

The objective of this activity is to have the cadets test their reaction time when well rested and after a lack of sleep and discuss their findings.

RESOURCES

- Reaction Time Sheet located at Attachment A, and
- Individual ruler located at Attachment B.

ACTIVITY LAYOUT

Nil.

ACTIVITY INSTRUCTIONS

1. Have each cadet assess, on a scale of one to ten, how sleepy they are—with “one” being not sleepy, “five” being somewhat sleepy and “ten” being ready to fall asleep instantly.

2. Divide the cadets into pairs.

3. Distribute copy of Attachment A and a ruler from Attachment B to each cadet.

4. Within each pair, have the first cadet hold a ruler with centimetres (between the thumb and forefinger) vertically at the 30 mark with the 0 mark toward the floor.

5. Have the second cadet position their forefinger and thumb at the 0 end of the ruler without touching it, so that they will be able to grab the ruler easily by closing their finger and thumb together.

6. Have the second cadet observe the ruler carefully and then have the first cadet release the ruler.

7. Have the second cadet close their thumb onto the ruler to stop it as soon as it moves.

8. Have the cadet mark the place where the partner’s fingers were when they stopped the ruler. The cadet should discard the first result if the ruler moved less than five centimetres.

9. Have the cadets repeat the release / catch process 20 times and record and average the results the Reaction Time Sheet.

10. Have the cadets change places and repeat the test.

11. Have the cadets as a class review the average values of the reaction times. Have cadets think about what really is being measured in the activity, and how distance in centimetres reflects reaction times.

12. Have cadets calculate the average value of their reaction times and the average value of their sleepiness scores.

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To calculate the average, add the values together and divide the sum by the number of values.



Example: If sleepiness score is a “3” and the average reaction time is ___, add 3 + ___ and divide the sum by ___ (number of values.) Discuss reaction time variance and alertness level.

13. Ask the cadets to identify the normal range of reaction times in their class population.



The cadets will take the ruler and data sheet home for the next two weeks and record their reaction time and calculate their average reaction times during each trial (night and morning).

14. Inform cadets that they will need to ask someone at home to help them with this activity, and suggest that the cadets perform this activity on a Friday or Saturday night so as not to disrupt their weekly routines.

15. Have cadets ask their parent(s) / guardian(s) for permission to stay up one or two hours beyond their normal bed time.

16. Instruct cadets to perform 20 trials of reaction times tests before they go to bed. Inform them that they must be feeling tired and ready to go to bed before doing this exercise. (Ask cadets to evaluate how sleepy they feel using the same scale as in the previous activity.)

17. Direct the cadets to repeat the activity after they have each had a good night’s sleep. (Again, ask them to evaluate how sleepy they feel using the same scale as in the previous activity.)

18. Have the cadets take home a copy of Attachment C Sleep Log Sheet and fill it in over the next 14 days. They will record how many hours they slept by filling in the columns for each day.

Teaching point 3 **Conduct an activity where the cadets discuss their sleep patterns from the proceeding two weeks.**

Time: 25 min Method: In-Class Activity



This activity takes place 14 days after the previous TP.

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ACTIVITY

Time: 25 min

OBJECTIVE

The objective of this activity is to have the cadets use the data recorded over the previous two weeks to assemble graphs and a fraction wheel to be used when discussing their sleep patterns.

RESOURCES

- Sleeping pattern graph,
- Sheet of white paper,
- Sheet of light coloured paper,
- Drawing compass,
- Protractor,
- Different coloured felt tip markers,
- Pair of scissors, and
- Pencil.

ACTIVITY LAYOUT

Nil.

ACTIVITY INSTRUCTIONS

1. Have the cadets discuss their sleep patterns they have recorded on the Reaction Time Sheet located at Attachment A.

2. Have the cadets, cut out the 16 cm diameter circle located at Attachment D out of a piece of white paper. Have them cut one radius line from the edge to the centre.

3. Have the cadets, using felt tip markers, indicate the 24 hours in a day by writing each hour in each segment.

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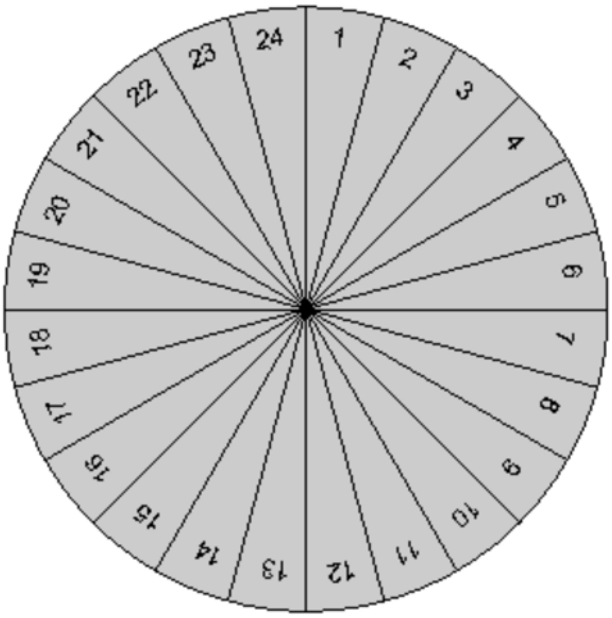
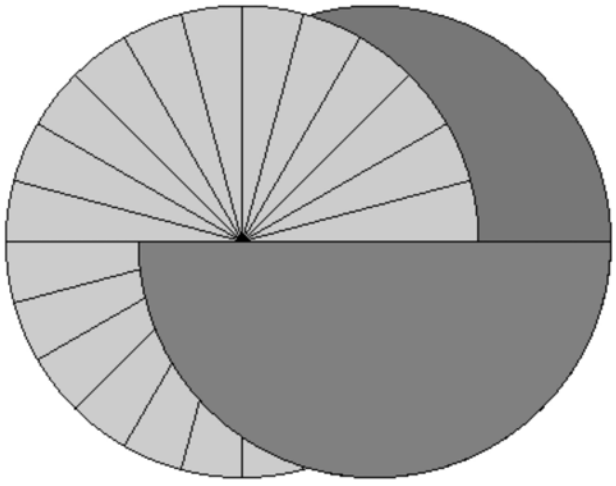


Note. Created by Director Cadets 3, 2011, Ottawa, ON: Department of National Defence.

Figure 2 Hours Indicated on Fraction Wheel

4. Have the cadets cut out the circle located at Attachment E out of a piece different coloured paper. Have them cut the 24 / 1 radius line from the edge to the centre.

5. Have the cadets slide the radius cuts of Attachment D and E together, with the lower numbers on Attachment D visible, so the two pieces make one circle.



Note. Created by Director Cadets 3, 2011, Ottawa, ON: Department of National Defence.

Figure 3 Fraction Wheel Assembly

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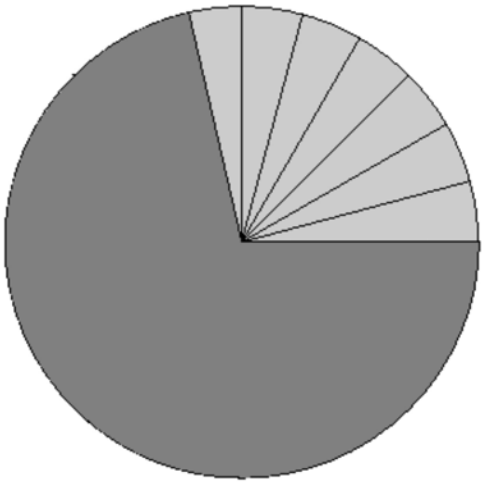

Note. Created by Director Cadets 3, 2011, Ottawa, ON: Department of National Defence.

Figure 4 Fraction Wheel Assembled

6. The Fraction Wheel is used to indicate the fraction of hours slept in a 24 hour period. Rotating circle E will show different amounts of circle D. If circle E represents one, as in the whole of one, then any parts of C showing will be a fraction of E. The circles are based on a 24 hour period, with D representing the 24 hours in one day and E demonstrating one day. Any part of D showing will be the indicated number of hours as a fraction of one day.

7. Ask the cadets to set their Fraction Wheel to the average number of hours of daylight within Earths light dark cycle (12 hours). Write the number as a fraction, 12/24. Have the cadets move their fraction wheels to the average number of hours they slept over the last 14 days.

8. Have the cadets calculate the fraction of the day that they slept on average, on the least amount of sleep day and on the most amount of sleep day.

9. Ask the cadets to compare their fractions and see how many cadets are getting enough sleep.

10. Have the cadets discuss the findings of the experiment.



Use the following questions to stimulate discussion.

- What are some of the environmental constraints that can prevent sleep?
- What can an astronaut do in space to ensure adequate sleep?
- What can lack of sleep cause?
- Where do astronauts sleep on the space station?

SAFETY

Nil.

END OF LESSON CONFIRMATION

The cadets' participation in the activity will serve as the confirmation of this lesson.

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CONCLUSION

HOMEWORK / READING / PRACTICE

Nil.

METHOD OF EVALUATION

Nil.

CLOSING STATEMENT

Sleep is an important factor in maintaining a healthy and efficient lifestyle. Lack of sleep causes many accidents and slows our day to day efficiency. Astronauts need to adjust to the challenges of sleeping while in space.

INSTRUCTOR NOTES / REMARKS

Nil.

REFERENCES

C3-350 The science of Sleep and Daily Rhythms. (2009). *Sleep Patterns*. Retrieved December 13, 2011, from http://www.nsbri.org/default/Documents/EducationAndTraining/MiddleSchool/Sleep/TSO_Sleep.pdf

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REACTION TIME SHEET

NAME		DATE	

CENTIMETRES WHEN CAUGHT																				
25																				
24																				
23																				
22																				
21																				
20																				
19																				
18																				
17																				
16																				
15																				
14																				
13																				
12																				
11																				
10																				
9																				
8																				
7																				
6																				
5																				
4																				
3																				
2																				
1																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

ATTEMPTS AT CATCHING THE RULER										
TIREDNESS	1	2	3	4	5	6	7	8	9	10

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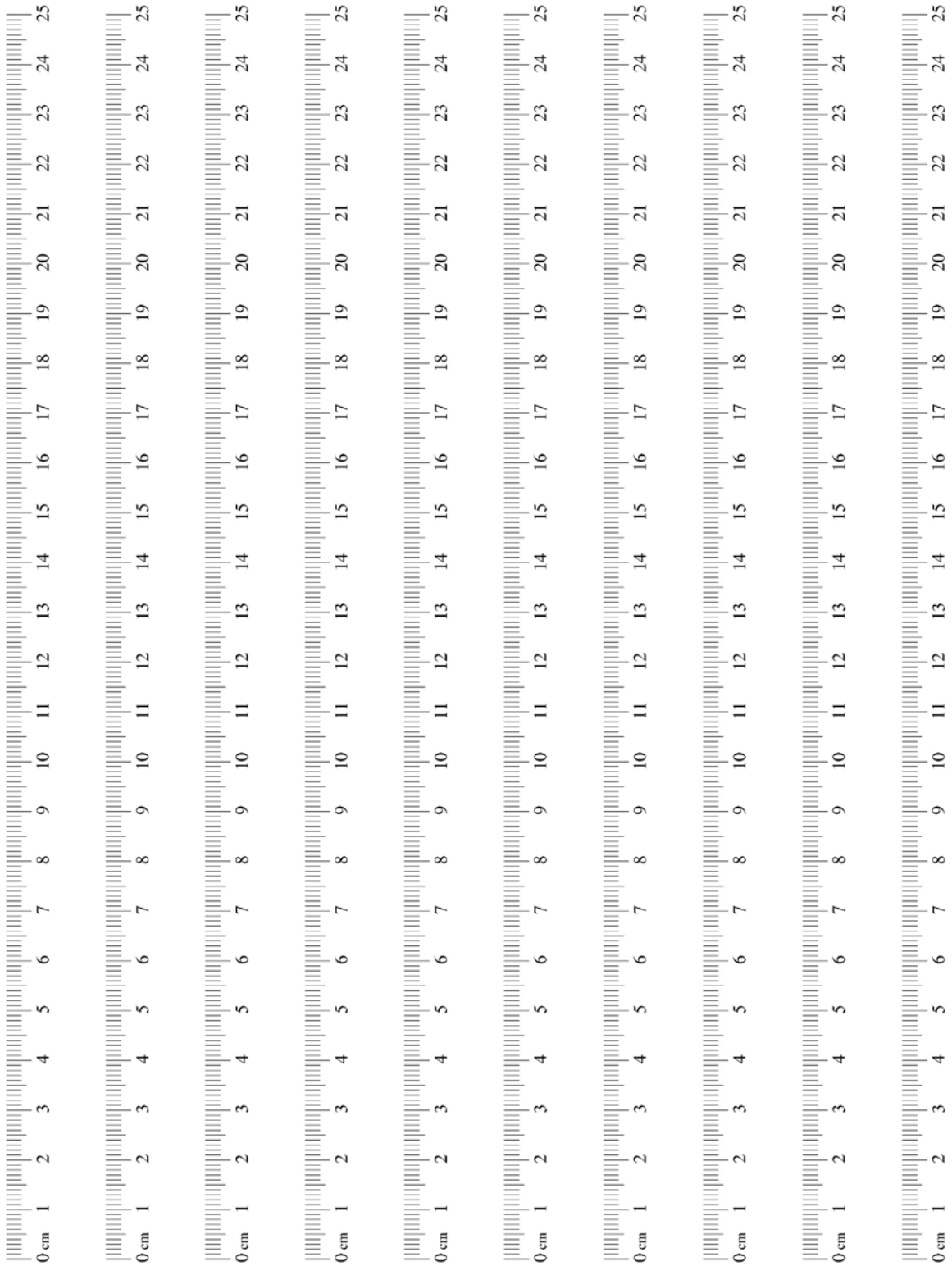

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SLEEP LOG SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
DATE →														
1200A														
0100														
0200														
0300														
0400														
0500														
0600														
0700														
0800														
0900														
1000														
1100														
1200														
1300														
1400														
1500														
1600														
1700														
1800														
1900														
2000														
2100														
2200														
2300														
TOTAL →														

Using the Sleep Log

Colour in the square representing the time you went to sleep and the time you woke up. Only count the hours.

With another colour, fill in the squares between the time you went to sleep and the time you awoke. Fill in any squares where you took a nap. Record the number of hours you slept for each 24 hour period in the TOTAL line.

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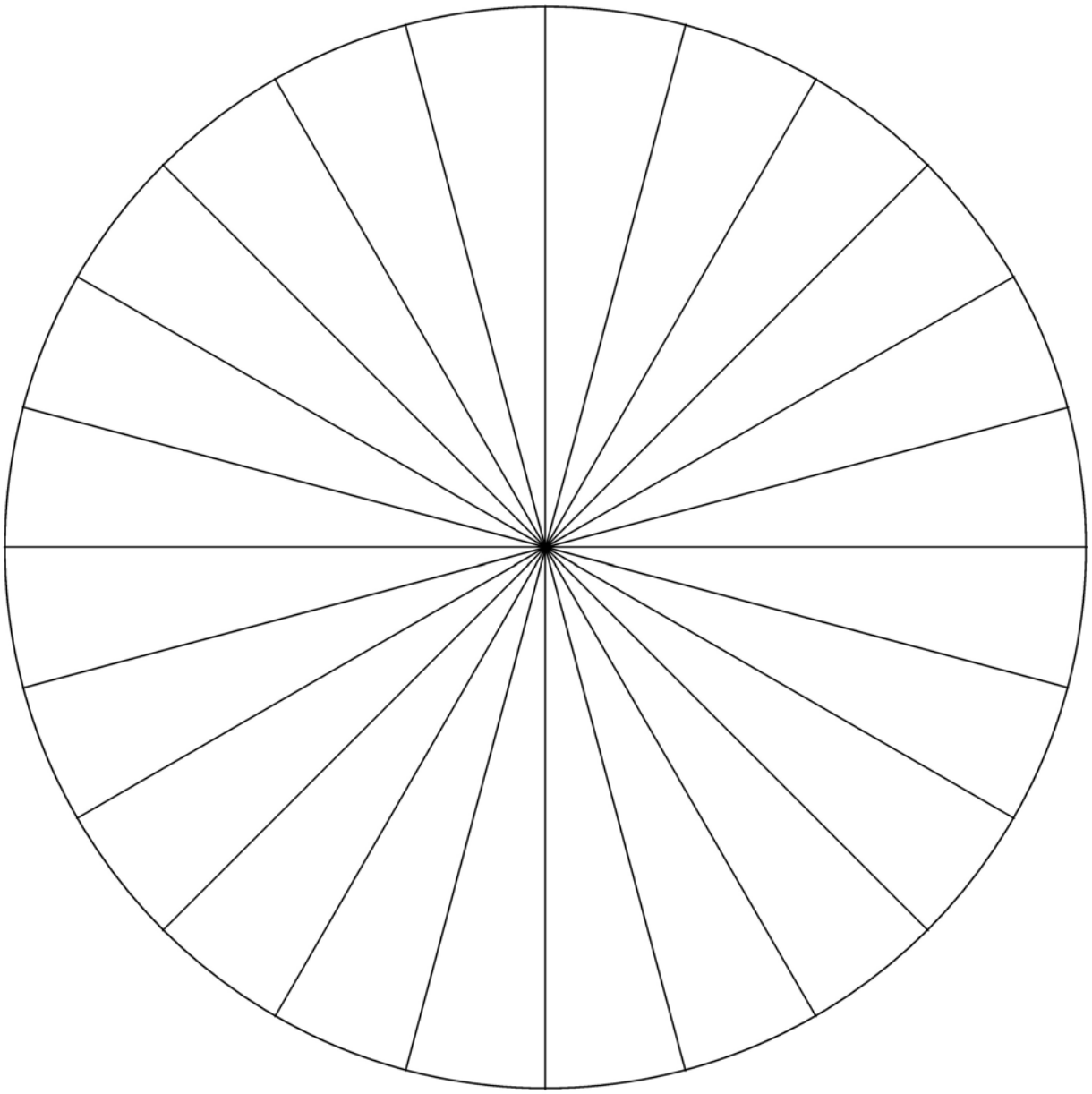
FRACTION WHEEL FOR 24 HOURS



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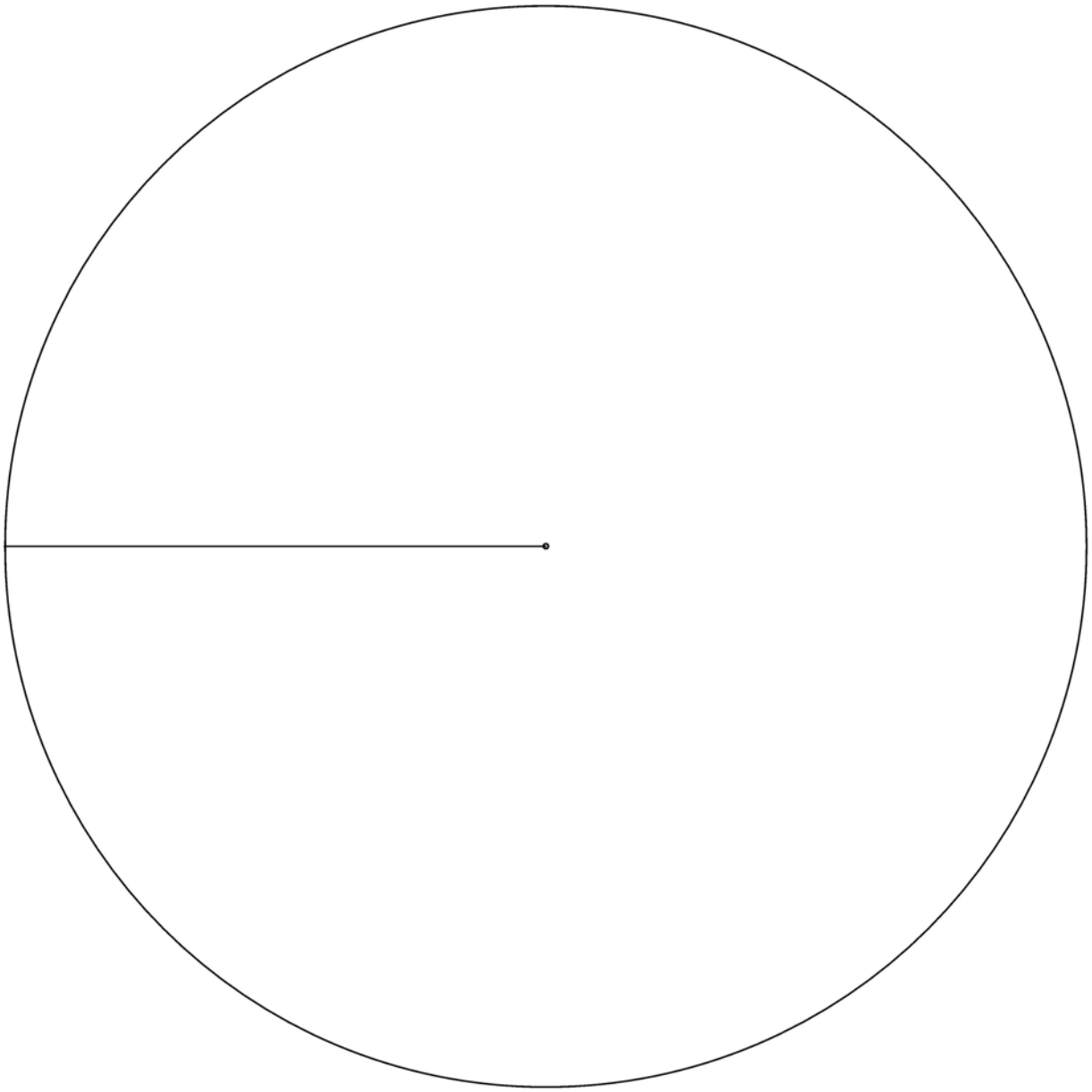
FRACTION WHEEL FOR ONE COMPLETE DAY



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