

## HOMeward BOUND



- An all-female expedition to Antarctica.
- Rallies scientists to join the climate change fight.
- Champions collaboration, connection, and leadership in science.

Ingenium **3 Pts**

## JOCELYN BELL BURNELL



- Discovered the first radio pulsar signals coming from a neutron star, credited as one of the most significant 20th century scientific achievements.
- Advocates for women in the fields of physics and astronomy.

Ingenium **5 Pts**

## RACHEL CHANG



- Researches how types of particles in the atmosphere change fog properties.
- Enriches our understanding of the forces that affect climate systems in the Arctic.

Ingenium **4 Pts**

## IRENE AYAKO UCHIDA



- Introduced cytogenetics, the study of chromosomes and heredity, to Canada.
- Alerted medical science to a possible connection between radiation and chromosomal abnormalities.

Ingenium **4 Pts**

## BRENDA MILNER



- Considered a founder of neuropsychology, which is the study of how the brain and nervous system affects how a person thinks and behaves.
- Demonstrated that memories are not all formed in the same way.

Ingenium **4 Pts**

## MELISSA SARIFFODEEN



- Co-founder and CEO of Canada Learning Code.
- Teaches digital literacy to women to reduce the technological gap between men and women.

Ingenium **3 Pts**

## ANN MAKOSINSKI



- Imagined helping developing countries with energy needs.
- At the age of 15, she invented the revolutionary Hollow Flashlight, powered by the heat from one's hand.

Ingenium **2 Pts**

## VEENA RAWAT



- First female to earn her PhD in electrical engineering at Queen's University.
- Spent nearly 40 years leading Industry Canada in wireless communications.

Ingenium **3 Pts**

## JILL TARTER



- Searched for extraterrestrial intelligence as Director for the SETI Institute.
- Worked on NASA's High Resolution Microwave Survey.

Ingenium **3 Pts**



**FRANÇOISE  
BARRÉ-SINOUSSE**



- Discovered the Human Immunodeficiency Virus (HIV).
- Findings were a first step towards preventative measures and antiretroviral treatment.
- Defines herself as a scientist-activist.

Ingenium **4 Pts**

**LYNN CONWAY**



- Famed pioneer in microelectronics chip design.
- She is a strong activist for equal opportunities and employment protections for transgender people.
- Her work formed the foundation of modern digital technology systems.

Ingenium **4 Pts**

**DONNA  
STRICKLAND**



- Paved the way toward the shortest and most intense laser pulses created by humankind.
- Influenced research scientists investigating how light interacts with matter in extreme conditions of high intensity.
- Calls herself a "laser jock."

Ingenium **4 Pts**

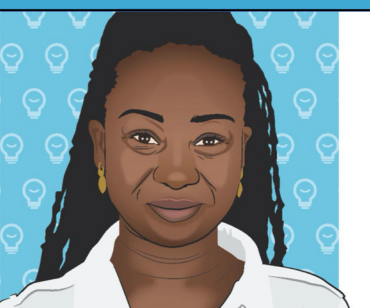
**NADINE CARON**



- Canada's first female Indigenous general surgeon.
- Strives to improve access to quality healthcare in northern First Nations communities.

Ingenium **4 Pts**

**EUGENIA DUODU**



- Earned a PhD in medicinal chemistry from the University of Toronto.
- CEO of Visions of Science and Network for Learning which offers STEM programs for low-income and marginalized youth.

Ingenium **5 Pts**

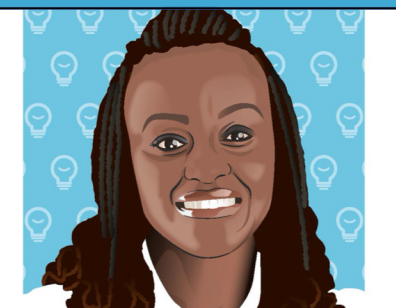
**REINA  
MARUYAMA**



- Conducts cutting-edge research on neutrinos and dark matter in nuclear particle astrophysics.
- Aims to discover what the universe is made of and why there is more matter than antimatter.

Ingenium **3 Pts**

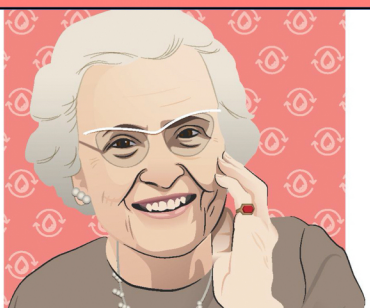
**CHARITY  
WANJIKU**



- Aims to alleviate energy poverty in Africa.
- Designs and develops innovative solar panels that also act as building materials through her company Strauss Energy Ltd.

Ingenium **4 Pts**

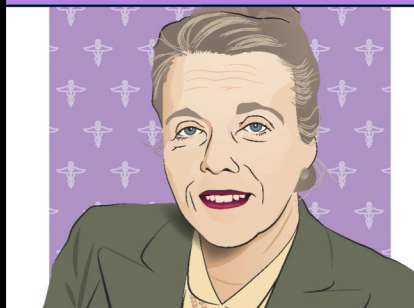
**HELEN IRENE  
BATTLE**



- 1st woman to earn a marine biology PhD in Canada.
- Pioneered the use of fish eggs to study cancer-causing substances in cell development.
- 1st zoologist to use laboratory research in marine biology.

Ingenium **4 Pts**

**MARION  
HILLIARD**



- Helped simplify the Pap Test, a screening procedure for detecting precancerous cells in the cervix.
- Increased women's participation in this lifesaving cancer screening process through advocacy work.

Ingenium **3 Pts**



**HAYLEY TODESCO**

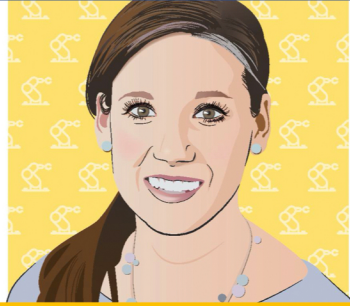


- Scientist and environmental entrepreneur.
- At age 16, developed a system that uses existing bacteria in tailing ponds to break down toxic pollutants.



**2 Pts**

**NATALIE PANEK**

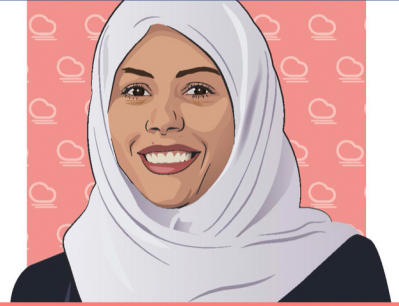


- Mechanical and aerospace engineer.
- Contributed to many space exploration programs, including a rover mission to Mars.
- Is a strong advocate for women in tech.



**3 Pts**

**HIND AL-ABADLEH**



- Air pollution expert.
- Won the Fulbright Canadian Chair in Climate Change.
- Explores the chemistry of air pollution, especially ground-level ozone and inhalable microscopic particles.

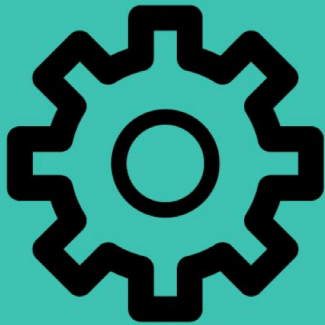


**3 Pts**

**ENGINEERING**



Discipline Card



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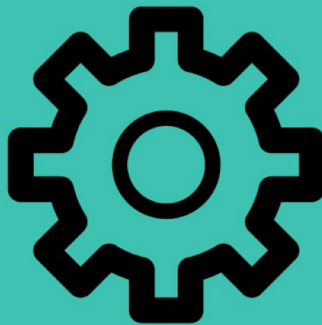


**ENGINEERING**

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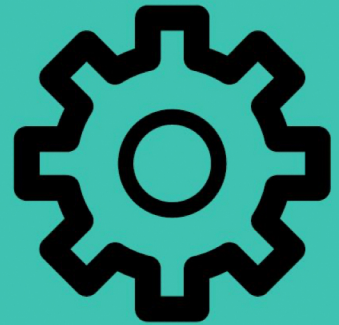


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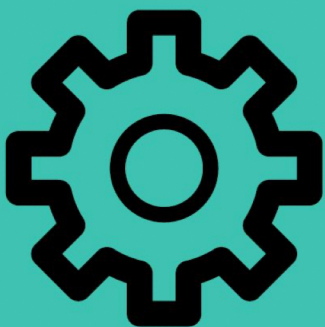


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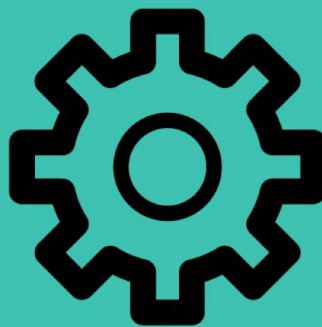


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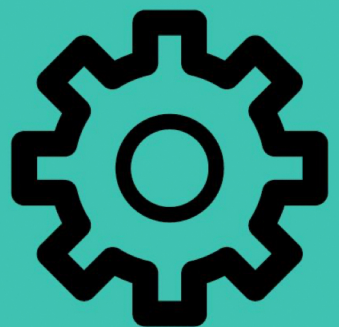


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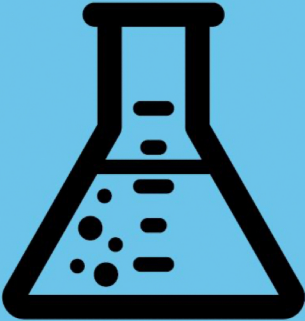
**ENGINEERING**




CHEMISTRY



Discipline Card




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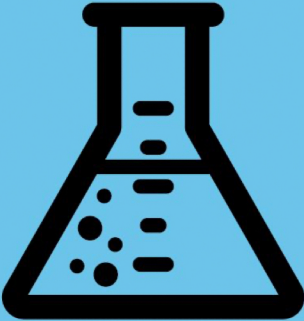
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CHEMISTRY



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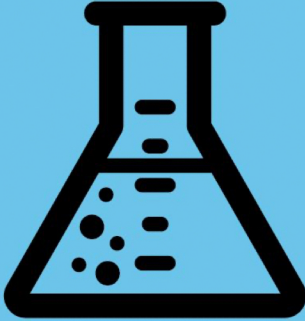
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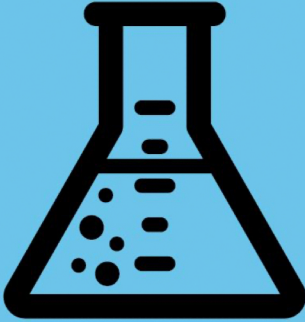
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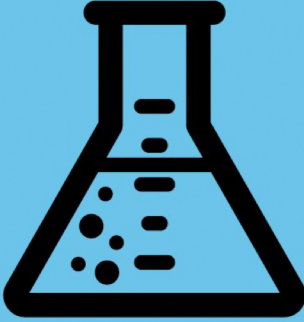
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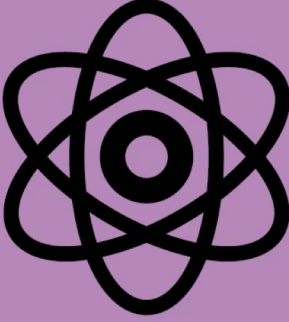
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Discipline Card

PHYSICS



Discipline Card




PHYSICS

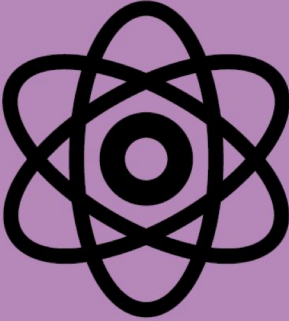
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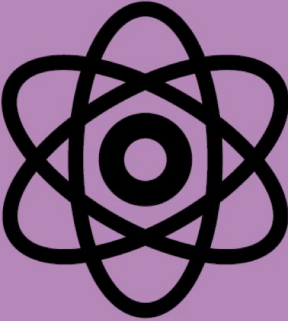
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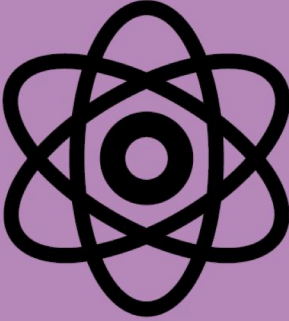
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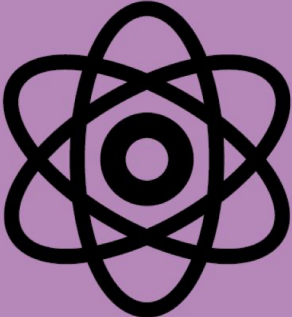
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PHYSICS



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COMPUTER SCIENCE



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MEDICINE



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**GEOSCIENCE** 

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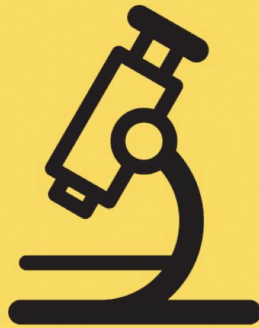
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# LIFE SCIENCE



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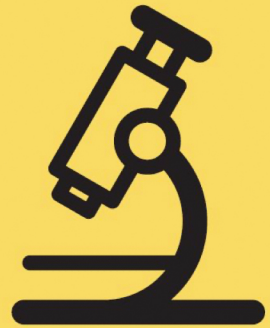
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# LIFE SCIENCE



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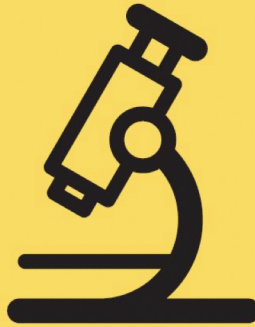
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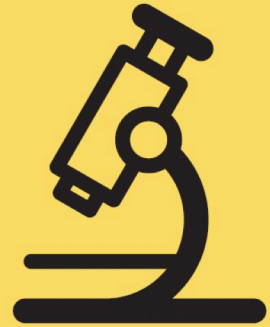
LIFE SCIENCE



# LIFE SCIENCE



Discipline Card



Discipline Card



LIFE SCIENCE



# ACTIVIST



Achievement Card



Achievement Card



ACTIVIST



# ACTIVIST



Achievement Card



Achievement Card



ACTIVIST



# ACTIVIST



Achievement Card



Achievement Card



ACTIVIST





INDUSTRY/POLICY 

Achievement Card



 Achievement Card

 INDUSTRY/POLICY

INDUSTRY/POLICY 

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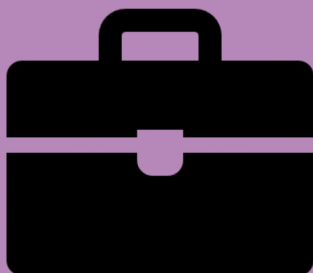


 Achievement Card

 ACTIVIST

**INDUSTRY/POLICY** 

Achievement Card



Achievement Card

 Ingenium

**INDUSTRY/POLICY** 

**PROFESSOR** 

Achievement Card



Achievement Card

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**PROFESSOR** 



**DOCTORATE**



Achievement Card



Achievement Card



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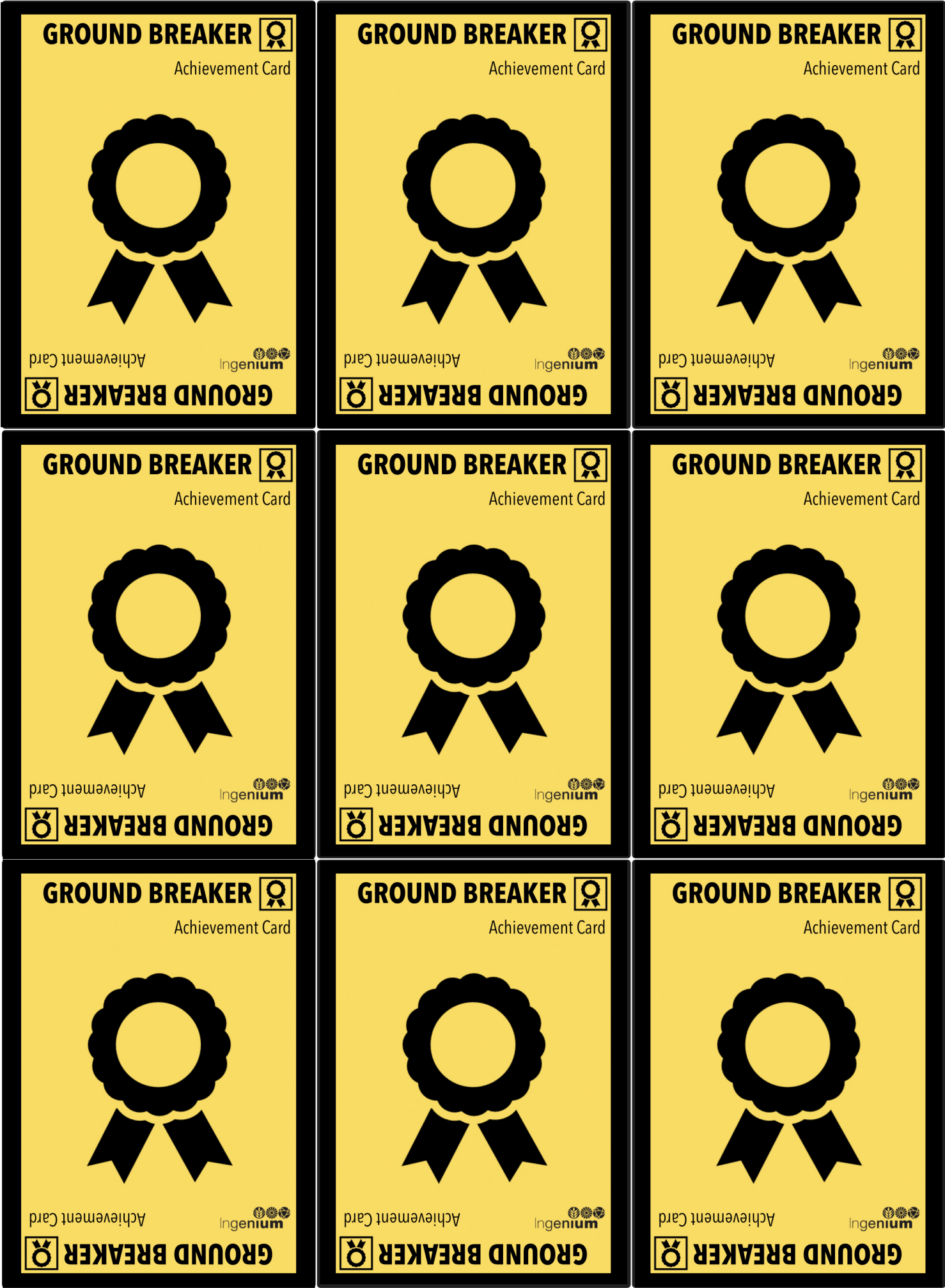


Achievement Card



**DOCTORATE**







**JUNIOR** 

Achievement Card



Achievement Card

**JUNIOR** 

Ingenium 

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Achievement Card

**JUNIOR** 

Ingenium 

**MODIFIER**

## Diversity makes better science.

Evidence has shown that mixed-gender teams produce research articles perceived to be of higher quality than single-gender teams.

*Immediately play this card when drawn. All players draw a card from the resource pile. MODIFIER cards must be discarded in BURN pile. All other cards can be kept in the player's hand.*

**MODIFIER**

Ingenium 

**MODIFIER**

## Representation is everything.

Women are consistently underrepresented in science and engineering workplaces. This is especially so in senior management positions, where they face a high attrition rate.

*You can play immediately or keep in your hand. Place this card on **anybody's** active scientist card. Doing so, means that the affected player will need one extra Discipline Card (of the same type\*) to complete that scientist hand.*

\* Note: Players can choose which discipline for scientists with two discipline requirements. If there are no active scientist cards, you can discard this in the BURN pile.

**MODIFIER**

Ingenium 

**MODIFIER**

## Girls don't see themselves as scientists.

Women are consistently underrepresented in science and engineering workplaces. This is especially so in senior management positions, where they face a high attrition rate.

*Immediately play this card when drawn. Place this card on one of your active scientist cards. Doing so, means that you will need one extra Discipline Card (of the same type\*) to complete that scientist hand.*

\* Note: You can choose which discipline for scientists with two discipline requirements. If you don't have any active scientist cards, you can discard this in the BURN pile.

**MODIFIER**

Ingenium 

**MODIFIER**

## A PhD does not mean security.

Despite the ever increasing number of women awarded with doctorates in STEM, various inequity challenges often make it harder for women to enter the STEM workforce, particularly at the upper levels.

*Play this card immediately and then place in the BURN pile. Discard all your cards from your hand this round.*

**MODIFIER**

Ingenium 

**MODIFIER**

## Mentors are awesome.

Women have blazed this trail before you, and many of them want to help others succeed.

*Immediately play this card when drawn. You may look through the BURN pile and remove one card of your choice to place in your hand. Discard this modifier card in the BURN pile.*

**MODIFIER**

Ingenium 

## MODIFIER

### Sexism delays science.

Charles Darwin delays publishing the Origin of Species by 20 years in part because mentor Adam Sedgwick writes that evolution is an idea that "could have been written by a woman."

*You can play this card immediately or keep in your hand. Give this card to any player. If that player has a GROUNDBREAKER resource card(s) in their hand or in active play, they must discard one into the BURN pile.*

MODIFIER



## MODIFIER

### Tokenism and Marie Curie.

Why it is that Marie Curie is almost always the one person that is brought up over and over when talking about women in STEM?

*Play this card immediately and then place in the BURN pile. If you have more than one Scientist in progress, you must DISCARD all of them - and their cards - except for one.*

MODIFIER



## MODIFIER

### Ways of the Queen Bee.

STEM women's careers suffer disproportionately from taking family leave. Many fathers do not take paternal leave even where it is available.

*Play this card immediately and then place in the BURN pile. Take an achievement card from another player and play it on one of your own Scientists.*

MODIFIER



## MODIFIER

### The leaky pipeline.

Women are half the population but hold only about a quarter of the science and engineering jobs in the US. As well, despite women receiving roughly half of the PhDs, they only hold less than a quarter of professorships.

*Play this card immediately and then place in the BURN pile. You must discard a scientist in progress: however the resource cards can be returned to your hand.*

MODIFIER



## MODIFIER

### Tokenism is not inclusion.

The Oxford Dictionary defines this as: The practice of making only a perfunctory or symbolic effort to do a particular thing, especially by recruiting a small number of people from under-represented groups in order to give the appearance of gender or racial equality within a workforce.

*Play this card immediately and then place in the BURN pile. If you have more than one Scientist in progress, you must DISCARD all of them - and their cards - except for one.*

MODIFIER



## MODIFIER

### FTW!

Congratulations! Your achievements and contributions to science and humankind are being recognized.

*You may use this MODIFIER card as a resource (achievement or discipline) wildcard.*

MODIFIER



## MODIFIER

### Biased family leave.

STEM women's careers suffer disproportionately from taking family leave. Many fathers do not take paternal leave even where it is available.

*Play this card immediately and then place in the BURN pile. When given to another player, that player must skip their next two turns.*

MODIFIER



## MODIFIER

### I'm with her.

Allies, the ones who are actively engaged, are so important.

*You can keep this card in your hand. Playable at any time - blocks the negative effects of one MODIFIER CARD. Burn after use.*

MODIFIER



## MODIFIER

### Trailblazer!

Although there is still much work to be done, things are better than they used to be. For this, we owe a huge thanks to the trailblazing efforts of many women in STEM.

*Play this card immediately and then place in the BURN pile. Pick up two extra cards from the resource pile and place in your hand for play. Note that negative MODIFIER cards (for either you or other players) are ignored and immediately placed in the BURN pile.*

MODIFIER





## MODIFIER

### We got your back.

Many successful women scientists have been supported by great organisations. For example check out Ingenium's exhibition "Iron Willed" which aims to shed light on the crucial role of women in STEM, on tour across Canada.

<https://womeninstem.ingeniumcanada.org/travelling-display/>

*You can keep this card in your hand and burn after use. The next scientist you complete can give their resources to any of your other scientists. Resources not needed by your current Scientists are burned.*

MODIFIER



## MODIFIER

### Stupid patriarchy.

"Where are these women? These women that are trailblazers in their field and yet you know who the TV reality stars are and not these amazing women who I'm inspired by and who you should be inspired by"

~ Natalie Panek

*Play this card immediately and then place in the BURN pile. Choose one RESOURCE card from another player's Scientist hand and BURN it.*

MODIFIER



## MODIFIER

### Stupid patriarchy.

"When I started secondary school, it was assumed that the girls would do domestic science and the boys would do science, and I wasn't too happy with that"

- Bell Burnell

*Play this card immediately and then place in the BURN pile. Choose one RESOURCE card from another player's Scientist hand and BURN it.*

MODIFIER



## MODIFIER

### Back handed compliment.

Unfortunately, this happens a lot. Said Voltaire of Emilie du Chatelet (physicist and mathematician), "She was a great man whose only fault was being a woman."

*Play this card immediately and then place in the BURN pile. Discard all your cards from your hand this round.*

MODIFIER



## MODIFIER

### Girl Power!

"Change must also come from within and we as women, we need to recognize how much change we can make happen if we believe in ourselves" - Natalie Panek

*Play this card immediately and then place in the BURN pile. Pick up two extra cards from the resource pile and place in your hand for play. Note that negative MODIFIER cards (for either you or other players) are ignored and immediately placed in the BURN pile.*

MODIFIER



## MODIFIER

### Stupid patriarchy.

"We need to create more opportunities and more space for girls to have meaningful experiences"

- Melissa Sariffodeen

*Play this card immediately and then place in the BURN pile. Choose one RESOURCE card from another player's Scientist hand and BURN it.*

MODIFIER



## MODIFIER

### Credit where credit is due.

Congrats! You've made a major breakthrough! However, credit is disproportionately given to a male colleague or advisor.

*Play this card immediately and then place in the BURN pile. Discard a RESOURCE card from one of your scientists.*

MODIFIER



## MODIFIER

### It's time to invest in women.

In Canada, men are twice more likely than women to start a business in STEM and when women do attempt to become entrepreneurs they have to face much more challenges than men in regards to accessing capital and securing investments.

*Play this card immediately and then place in the BURN pile. You must discard all of the Industry/Policy card that you have both in your hands or in active play.*

MODIFIER



## MODIFIER

### Kept on the "right" track.

A recent survey found that girls in Europe become interested in STEM subjects around age 11, but due to conformity to social expectations, gender stereotypes, gender roles and lack of role models, quickly lose interest when they are 15.

*Play this card immediately and then place in the BURN pile. If you have more than one Scientist in progress, you must DISCARD all of them and their cards except for one.*

MODIFIER



## WoC MODIFIER

### Good girls play nice.

Women in STEM report pressure to fill traditionally feminine roles. Asian-Americans report the most backlash for assertive, self promoting behaviours.

*Play this card immediately and then place in the BURN pile. Play on any active scientist who is a woman of colour (if yours is the only one, you have to play on your own). This scientist must discard one of their resource cards. If there are no active women of colour scientists, you may BURN this card.*

WoC MODIFIER



## WoC MODIFIER

### Prove it again and again...

Women in STEM, particularly women of colour, often have to provide more evidence of being competent to be treated as equally capable as men.

*Play this card immediately. Add this card to any active scientist who is a woman of colour (if yours is the only one, you have to play on your own). This scientist now requires an extra resource card to complete (it can be any of the ones required). If there are no active women of colour scientists, you may BURN this card.*

WoC MODIFIER



## WoC MODIFIER

### Mistaken for a janitor.

Almost half of black and latina women in STEM fields have been mistaken for a janitor or admin staff in their own offices.

*Play this card immediately and then place in the BURN pile. Play on any active scientist who is a woman of colour (if yours is the only one, you have to play on your own). This scientist must discard one of their resource cards. If there are no active women of colour scientists, you may BURN this card.*

WoC MODIFIER





## RULES

01

### The Women in Science and Engineering Starter Deck

Although patriarchy's stranglehold on science and engineering is ever-weakening, it still causes significant hurdles for scientists and engineers worldwide. You have the chance to support ground-breaking women in science and technology by securing resources for their careers. Advance science by completing as many careers as possible!

#### Objective

The objective of the game is to obtain as many points as possible. The player with the most points at the end of the game is the winner. Points are gained by completing *Scientist/Engineer Cards*. In order to complete a *Scientist/Engineer Card*, the appropriate combination of *Resource Cards* must be collected. Points from any incomplete *Scientist/Engineer Card* is subtracted from your total score at the end of the game.

Note that this deck also has a few blank cards for you to create and add your own DIY Scientist Card and/or your own DIY Modifier Card. If you tweet or instagram these DIY cards with the hashtag #ingeniumdeck, we'll take a look in case there are future expansion decks!

## RULES

02

### The Deck

This deck contains a total of 74 cards which includes 21 Scientist/Engineer Cards, 77 Resource Cards, and 22 Modifier cards. This game is best played with 3 to 5 players, but can be played with 2.

Length of playing time is approximately 30 to 45 minutes but this can be easily adjusted by lowering the number of Scientist/Engineer cards used (see below).

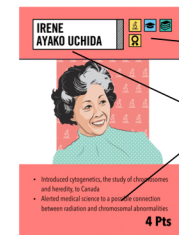
#### Scientist/Engineer Cards:

Players obtain points upon completion of Scientist/Engineer Cards. Each of these cards requires a specific combination of Resource Cards which must be assigned to the scientist/engineer in order to be completed. Usually, the number of Resource Cards required to complete a project is the number of points collected by the player upon completion. At the end of the game, incomplete Scientist/Engineer Cards result in negative points equal to the point value of the card.

Note that some of the scientists/engineers are women of colour (WoC), and therefore may have additional obstacles in game. Because of this, their cards may be more difficult to complete and are consequently worth an extra point.

## RULES

03



Symbols for resources required for project completion (discipline and achievements)\*

Name and some interesting biographical notes.

Number of points won if the project is completed. Points lost if incomplete.

\*Note that women of colour are not specifically labeled as such.

#### Resource Cards:

*Resource Cards* include *Discipline Cards*, and *Achievement Cards* which contribute towards completing *Scientist/Engineer Cards*. They also include *Modifier Cards*, which can affect gameplay in special ways.

**Discipline Cards:** The field(s) of research that the woman was involved in.

**Achievement Cards:** These cards reflect additional activities that the woman may have been involved in.

## RULES

04

#### Modifier Cards:

These cards generally reflect issues related to gender equity and have effects (explained in the card text) that can impede or help a player complete their Scientist/Engineer cards. Note that some Modifier Cards are specifically aimed at women of colour scientists/engineers (WoC).

#### Set Up

##### The Playing Field

There are 4 main card "piles" in the game.

1. Resource Card pile - contains the shuffled up Resource Cards face down.
2. Scientist/Engineer Card pile - contains the Scientist/Engineer Cards face down.
3. Discard pile - contains discarded cards face up (at the beginning, this will be empty).
4. Burn pile - (also empty at the beginning) contains face down Discipline and Achievement Cards that were used to complete Scientist/Engineer Cards as well as used Modifier Cards.

Once the Resource Card pile is completely used up, the Burn pile and Discard pile (minus the top card) are combined, shuffled and used to replenish the new Resource Card pile.

## CREDITS

Game Design: Garance Thery. With thanks to Katie Taher, Kathryn Turner, Kashifa Hafeez, Maemi Ishida, Lisa Ying, Sidney Ang, Genevieve Leduc-Robert, Lu Li, Sam McKinnon, and David Ng.

Art by nineSixteen Creative Inc. Card back design by Suzanne Norris, Phylo logo by Haley Fiege.

Special Thanks to Sandra Corbeil, and the Michael Smith Laboratories.

This project was an extension of the Women in STEM initiative by Ingenium - Canada's Museums of Science and Innovation. Learn more about Ingenium and the Initiative at:

IngeniumCanada.org  
WomenInSTEM.IngeniumCanada.org

For more information about the PHYLO card game, please visit <http://phylogame.org>

## RULES

06

from the Scientist/Engineer Card and Resource Card pile, etc). The player must pick up both cards before looking at either of them. Only the top cards in the Discard pile can be drawn (ie. you cannot look through Discard pile).

**2. Action:** The player can now choose to do as many of the following actions during their turn.

i) Start and/or work on a scientist/engineer.

To start a scientist/engineer, place a Scientist/Engineer Card face up in front of you. By doing this, you commit to finishing the card. If you do not finish it, you will be deducted the point value of the project at the end of the game. There is no limit to the number of projects you can work on at the same time. Finishing a scientist/engineer card, involves placing required resource cards from your hand beside the scientist/engineer card on the playing field.

ii) Complete a scientist/engineer.

A scientist/engineer is completed when you have acquired all the Resource Cards needed for the project and placed them beside the Scientist/Engineer Card on the playing field. Take the completed Scientist/Engineer Card and set it aside. Place the associated Resource Cards face down in the Burn pile.

## RULES

07

iii) Use a Modifier Card.

Modifier Cards are Resource Cards that result in special actions. They might help complete or disrupt a player's progression. Read these cards carefully. Many require you to use them immediately, but there are a few that let you keep in your hand. As well, there are a few WoC Modifier Cards which can only be used on women of colour.

**3. Discard.** At the end of your turn, you must discard cards from your hand into the Discard pile face up if your hand size is LARGER than the number of Scientist/Engineer Cards you have in progress. For example, if you are working on one Scientist/Engineer Card, you can only hold one card at the end of your turn. If you have no active Scientist/Engineer Cards (completed Scientist/Engineer Cards do not count), you must discard your entire hand. Note that Scientist/Engineer Cards can only be discarded if they are in your hand (ie. Active ones on the table cannot be discarded).

## RULES

08

### Ending the Game

When the last Scientist/Engineer Card\* is drawn from the Scientist/Engineer pile, the next player to complete a Scientist/Engineer Card ends the game. After this player finishes a Scientist/Engineer Card, all players get one more turn before the game ends. Then, players tally up all their points: positive points for completed Scientist/Engineer Cards and negative points for unfinished Scientist/Engineer Cards left on the field. The player with the most points wins the game.

For example: Dave completed a 4-point card, a 2-point card, and has an unfinished 3-point card. He gets  $4 + 2 - 3 = 3$  points at the end of the game.

\* Note that you can play with fewer Scientist/Engineer Cards to start. This can be done to adjust the total playing time.

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