The Scientists of Catan

Table of Contents

Introduction  2
Changes  5
Initial Setup  5-6
Gameplay  6-7
  (Various Costs  6)
  (Rolling a 7  7)
  (Victory Points  7)
Trivia Questions  8-11
How to Make Scientists of Catan  12-15
  (Components of a Game  12)
  (Materials Needed  13)
  (Instructions  14)
The University of Catan lies before you! Your goal is to become the best scientist at the university with the five different resources at your disposal: time, ideas, grants, graduate students, and citations. Each of these five resources is available in the (metaphorical) landscape of the university.

You will begin the game with two papers and two experiments at your disposal. Using your social and economic capital, accumulate at least 10 victory points to win!

For 2-6 Players
Game time approximately 45 minutes – 1.5 hours

Introduction:

This game is based on the experiences of scientists active today. Scientists working at universities may find more to relate to in this game than scientists working in industry or at national laboratories, but all scientists should find elements of the game familiar to their experience or to the experiences of people they know. Similarly, academics in science may find it easier to relate in certain respects to this game, but academics more broadly will not find this game totally unfamiliar.

This game can be played with a variety of attitudes. Players are allowed (and encouraged!) to cooperate with other players (e.g. by trading resources or ‘co-authoring’ papers). Cutthroat play is also possible, with certain career development cards or by mischievous/malicious use of the plagiarist (‘credit robber’).

Players should note that certain events in game play are not under any player’s control, while in other respects the attitude or strategy players bring to the game can significantly alter the game’s tone. In the same way, scientific practice today is to a certain extent under a scientist’s personal control, but much of a scientist’s career is determined by the other ‘players’ or the conventions (i.e. rules) of the larger society.

Although this game can and should be simply a source of fun for the most part, players should also use this as an opportunity to compare their actions and experiences in the game with real world events. Some development cards will provide subjects for thought. Furthermore, a player should also question whether the competitive attitude usually adopted in games is necessarily desirable in scientific practice. Will you play competitively or cooperatively? Will you help advance others’ careers or just your own? Of course there is always the option to refuse to play by the rules entirely…

“The Germans Play Monopoly”
Reproduced with permission from Existential Comics artist Corey Mohler
http://existentialcomics.com/comic/19
You know the car is the most phallic of the pieces; it doesn’t surprise me that it is the most popular, or that you’ve chosen it, Carnar.

You know, Freud, have you ever thought to yourself: “Maybe, just maybe, every single person on Earth isn’t totally obsessed with penises—maybe it’s just me?!”

And yet, I noticed that you aggressively traded so you could own every railroad.

Because they are worth more together!

I was happy to be rid of them, they are a lesser type of cards—unable to ascend to the highest level.

You know the point of the game isn’t to get one of every color, right, Nietzsche?

My property portfolio may be weak, but my will is strong. At least I don’t just follow the herd strategy of buying everything I land on.

Oh yes, please, conflate your obsession with being different with a personal strength some more—we never tire of it! You are terrible at Monopoly; yet another sign that you are the Übermenschen! I have never seen so many unresolved complexes in my life.

Coming from the man who stole half my ideas, and then claimed to have never read me.
You know your theories don’t describe anything, at all, right, Freud? It’s all unverifiable, unempirical nonsense, and totally meaningless.

As meaningless as your relationship with your mother?

She had a lot to deal with! She did the best she could!

Ah, yes, and now we are making some progress.

Your turn, Marx.

Very well.

Oh, look at that! A six. That puts you on... let's see... oh my, yes, right on Boardwalk and with my hotel to boot. And it looks as if you are a bit cash poor at the moment, poor Marx. Time to start mortgaging, I'm afraid.

The great economic theorist, and yet here we are. You never were any good at personal finance, were you?

Revolution!
Changes:

This game is based on the popular game “Settlers of Catan.” Gameplay is virtually identical, with a few small changes. Players are now called Scientists and instead of a Bank there is a Funding Agency. Instead of Harbors there are Conferences.

Names of resources and buildings have also been changed. Instead of Roads, Settlements, and Cities, there are Experiments, Papers, and Books, respectively. There are also different resources: Time, Ideas, Grants, Graduate Students, and Citations.

There are a few changes beyond the names. It is now possible to co-author a paper. I.e., two or three settlements of different scientists may be placed at the same corner of a hex. They must all be connected to roads which lead out along different hex edges.

There is also an additional Trivia option whenever a 7 is rolled.

Initial Setup:

1. Initial Board Setup.
Tile the hexagons together so that the resources are approximately randomly distributed. Place, again in as random an order as possible, the numbered circular tiles on top of each resource hexagon. Do not place a number on the desert. Place the credit robber on one of the desert (old paper) tiles. Evenly space the harbor tokens on the outside edges of the hexagon group.

2. Initial Scientist Setup.
Roll the two dice to determine scientist turn order. Every scientist should then take two papers, two experiments, and the construction card of their color from the funding agency.

In descending turn order, each scientist will place one paper at a hexagon corner on the map. One experiment should be placed on an edge adjacent to that paper.

Scientists will again take turns placing their second experiment and paper on the board. In the initial setup, as in the rest of the game, scientists may choose to ‘co-author’ a paper. This means that two or three papers may be placed on the same corner. However they must each be connected to an experiment, and multiple experiments cannot share the same edge.
Note too that there must be at least two edges between a scientist’s papers. A single scientist cannot place two of his or her papers one edge apart, whether or not they are connected by a road. Papers of different scientists may be as close as one edge apart.

**Gameplay:**

Each turn begins with the scientist whose turn it is rolling two dice. Each resource hexagon is labeled with a number from 2-12, excluding 7. Each scientist who has a paper adjacent to a hexagon marked with the number just rolled will receive one resource of the type corresponding to that hexagon.

During a scientist’s turn, he or she may spend resources to acquire new experiments or papers from the funding agency. New experiments and papers must be placed appropriately on the board as soon as they are acquired.

A scientist may also expend resources to upgrade a paper into a book. Books cannot be bought outright; they can only come from upgrading a paper. If a book is adjacent to a hexagon when that hexagon’s number is rolled, that scientist will receive 2 or that resource.

A scientist may also expend resources to buy a career development card. Some cards, such as victory point cards, must be played immediately. Otherwise, a scientist may choose to keep the card in their hand until such time as they wish to play it.

<table>
<thead>
<tr>
<th><strong>Various Costs</strong></th>
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<tbody>
<tr>
<td>Experiment</td>
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<tr>
<td>Paper</td>
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<tr>
<td>Book</td>
</tr>
<tr>
<td>Career Development Card</td>
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</table>

Scientists can also acquire resources during their turn through trading. Scientists may trade with the funding agency any 4 resources of the same kind for 1 resource of a different kind. E.g., a scientist could trade 4 citations for 1 graduate student.

If a scientist has a paper adjacent to a conference, that scientist may trade any 3 resources of the same kind for 1 resource of a different kind.

A scientist may also initiate trade of any type with another scientist.
**Rolling a 7:**

If a 7 is rolled, no resources are given out. The scientist who rolls the seven may choose to do one of two things.

1. The scientist can move the **credit robber** to another hexagon. Any hexagon with the credit robber does not give out resources even if its number is rolled. The credit robber can also be moved during a scientist’s turn if that scientist uses a **mentor**. After enlisting the help of the mentor, the mentor should remain face-up in front of that scientist.

2. The scientist may make a bet with the funding agency to get more resources. The scientist may only make a bet on resources that they already have. For example, the scientist may go double-or-nothing on a graduate student in their hand. The scientist wins (or loses) the bet by their ability to answer a **trivia** question. Another scientist should read out the question and peer-review the answer using the questions provided in a subsequent section of this manual.

After either moving the knight or challenging another scientist to trivia, the scientist’s turn continues as usual.

**Victory Points:**

The first scientist to reach at least 10 victory points in their turn wins.

- Every experiment is worth 1 point, every paper is worth 1 point, and every book is worth 2 points.
- Some career development cards will also award victory points.

In addition, there are two awards which can be earned: **Largest Mentor Army** and **Longest Experiment**. Each is worth 2 victory points. The scientist who has called on mentors more than any other scientist receives the largest mentor army award. Whenever a mentor is called upon, that mentor card should remain face-up in front of the scientist. The scientist with the longest chain of sequential experiments earns the Longest Experiment award.
**Trivia Questions:**

1. Who is the first African American woman to earn a Ph.D. in any field at MIT and only the second to earn a Ph.D. in physics in the entire United States?  
   **Answer:** Shirley Ann Jackson

2. Who was the first woman elected to the American Academy of Arts and Sciences in 1848 and to the American Association for the Advancement of Science in 1850?  
   **Answer:** Maria Mitchell

3. Who became the first African American to serve as president of the Optical Society of America?  
   **Answer:** Anthony Johnson

4. Who were the first three women elected to the American Philosophical Society (all in 1869)?  
   **Answer:** Maria Mitchell, Mary Somerville, and Elizabeth Cabot Agassiz

5. Who was the first African American to receive a Ph.D. in the United States in 1876 and only the 6th of any race to receive a Ph.D. in Physics? His dissertation was on “Measuring Refractive Indices”  
   **Answer:** Edward Bouchet

6. Who were the first female members of the Royal Astronomical Society?  
   **Answer:** Mary Somerville and Caroline Herschel (in 1835)

7. Who became the second African American to earn a Ph.D. in physics in the United States in 1918?  
   **Answer:** Elmer Imes

8. Who is largely thought to have been left out of sharing the 1957 Nobel Prize in Physics for her experiment which refuted the idea of the conservation of parity?  
   **Answer:** Chien-Shiung Wu

9. According to the National Science Foundation, which university produces more African Americans who earn doctoral degrees in the natural sciences than any other university in the country? Elmer Imes founded this university’s physics department in 1930.  
   **Answer:** Fisk University

10. John Bardeen, Linus Pauling, and Frederick Sanger all won two Nobel Prizes in a single field. (Physics, Chemistry, and Chemistry, respectively.) Who is the only person to have won two Nobel Prizes in two different fields?  
    **Answer:** Marie Curie, in Physics and Chemistry
11. Maria Goeppert-Mayer was the second woman after Marie Curie to win a Nobel Prize in Physics. What did she win it for?
   **Answer:** For her mathematical model of nuclear shells. She proposed that the nucleus was a series of closed shells, with pairs of neutrons and protons coupling together which she described as “like a room full of waltzers.”

12. From the 1940s until the 1980s, many African American women such as Melba Roy Mouton, Katherine Johnson, and Christine Mann Darden worked as what at NASA’s Langley Research Center?
   **Answer:** Computers

13. Who discovered in 1901 that one element could change into another through radioactivity?
   **Answer:** Harriet Brooks

14. Who was the first African American woman to earn a Ph.D. in physics in the United States?
   **Answer:** Willie Hobbs Moore

15. Who became the first ever official female physics professor in 1732?
   **Answer:** Laura Bassi

16. Who was the first African American in space?
   **Answer:** Guion Bluford

17. Who discovered the mathematical nature of the conservation laws of physics in 1918?
   **Answer:** Emmy Noether

18. Who calculated the trajectory for the famous Apollo 11 mission to the moon?
   **Answer:** Katherine Johnson

19. Who discovered pulsars in 1967?
   **Answer:** Jocelyn Bell Burnell

20. Which African American astrophysicist became the host of the TV show *Cosmos* in 2014?
   **Answer:** Neil deGrasse Tyson

21. Who was the first woman in space?
   **Answer:** Valentina Tereshkova

22. As of 2012, approximately 79% of all physics faculty (at all levels) were White. How many physics faculty were African American, Hispanic, or Asian American? (Player can answer 1 out of the 3. Count the answer as correct if it is within 2
percentage points.)
**Answer:** African American (2%), Hispanic (3%), and Asian American (14%)\(^1\)

23. **Who was the first female president of the American Physical Society in 1975?**
**Answer:** Chien-Shiung Wu

24. **Who was the first female president of the American Astronomical Society in 1976?**
**Answer:** Eleanor Burbidge

25. **African Americans make up about 13% of the population of the United States. As of 2004, approximately what percentage of bachelor’s degrees in physics and the geosciences were awarded to African Americans?**
**Answer:** 4% and 2%, respectively.\(^2\)

26. **Who was the first female space shuttle commander in 1995?**
**Answer:** Eileen Collins

27. **Which African American astronomer published almanacs that were used in the 18th century and helped design the city of Washington, D.C.?**
**Answer:** Benjamin Banneker

28. **In 1945 Marjory Stephenson and what physicist became the first two female fellows of the Royal Society of Great Britain. This physicist is famous for her work using x-ray diffraction methods to show that a benzene ring is flat. She was also the first female president of the British Association for the Advancement of Science.**
**Answer:** Kathleen Lonsdale

29. **In 2012 Hispanics constituted 16.7% of the U.S. population.\(^3\) What percentage of physics bachelor’s degrees were earned by Hispanic students? (Count the answer as correct if within 1 percentage point.)**
**Answer:** Approximately 5.5%.\(^4\)

30. **Name the Seven Sisters colleges.**
**Answer:** Barnard, Bryn Mawr, Mount Holyoke, Radcliffe, Smith, Vassar, Wellesley

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31. Who worked with Gerhard Sessler at Bell Labs to develop the foil-electret microphone – the first small microphone that did not require a battery? His invention revolutionized the communications industry.
Answer: James West

32. As of 2010, women constituted what percentage of physics faculty members in the United States (at all levels)?
Answer: Approximately 14%5

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5 Ivie, Rachel; White, Susan; Garrett, Arnell; Anderson, Garrett. “Women among Physics & Astronomy Faculty: Results from the 2010 Survey of Physics Degree-Granting Departments.” AIP Statistical Center Research Report, August 2013.
How to Make a Scientists of Catan Set

Components of a Game (This assumes 6 players)

- 30 Hexagons (6 Grants, 6 Ideas, 6 Grad Students, 5 Citations, 5 Time, 2 Desert)
- 120 Resource Cards (24 Time, 24 Citations, 24 Grad Students, 24 Grant, 24 Ideas)
- 41 Career Development Cards (20 Mentor Cards, 6 Victory Point Cards, 15 Gameplay Cards)
- 6 Building Cost Cards
- 2 Victory Point Award Cards (1 Largest Mentor Army, 1 Longest Experiment)
- 11 Die-cut circular Conference Chits
- 28 Die-cut circular Number Chits [Two x "2" (*), Three x "3" (**), Three x "4" (***), Three x "5" (****), Three x "6" (*****), Three x "8" (******), Three x "9" (****), Three x "10" (**), Three x "11" (***), Two x "12" (*)]
- 30 Papers (5 of each color Blue, White, Red, Orange, Green, Brown)
- 24 Books (4 of each color of each color Blue, White, Red, Orange, Green, Brown)
- 90 Experiments (15 of each color Blue, White, Red, Orange, Green, Brown)
- 2 Dice
- 1 Credit Robber
**Materials Needed**  
*(This assumes 6 players)*

- PDFs of *Scientists of Catan* Cards and *Scientists of Catan* Tiles
  - Optional: Laminator
  - Optional: Velcro hooks and a 36” by 36” piece of felt

- Paper Cutter/Scissors
  - Optional: Xacto knife with Cutting surface

- Tokens to represent: Experiments, Papers, Books
  - For Experiments:
    - 90 paperclips, with 15 each in six different colors
    - Optional: 90 inches of square wooden dowel, ¼ inch on a side. Will need a small wood cutter/saw
  - For Papers and Books:
    - Post-it notes in 6 different colors. (Every player will need at least 9 post-it notes, 5 for papers and four for books.)
    - Optional: Can purchase small tokens to represent.⁶

- For Number and Conference Disks:
  - Wooden discs or round stickers (39 total)
    - Thin-tipped sharpie or pen

- 2 Dice
- Small Object to represent the robber

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Instructions

1. Print 6 copies of the PDF for the hexagon tiles. These should be printed single-sided. For a standard game board for 4-6 players, you will need 6 Grants, 6 Ideas, 6 Grad Students, 5 Citations, 5 Time, and 2 Desert tiles. Cut out the hexagons using scissors or a paper cutter. You could laminate them to make them stronger.

   *Fancy Alternative:* To make sturdy hexagons, print out six copies of the tile pdf onto full-sheet label paper.7 Paste the label paper onto sheets of chipboard,8 and then use an Xacto knife to cut out the hexagons.

2. Print the PDF file of resource and career development cards. These should be printed double-sided. They will also print to Avery 5392 pages. Cut them out using scissors or a paper cutter. These cards could be laminated.

   *Fancy Alternative:* You can use an online service to print the cards directly to playing cards.

3. A number of smaller items, including the dice, conference chits, number chits, robber, papers, books, and experiments will need to be obtained.

   a. Dice can usually be purchased from local grocery or drug stores.

   b. The robber can be any small object. Small robber figures can also be purchased.9

4. Discs will be needed to represent the conferences and the number chits on the hexagons. The conference chits and number chits can be made by purchasing small unpainted wooden discs.10 Write on these using a thin-tipped sharpie. Round stickers can also easily be used and then written on with a pen.

   a. Write numbers on 28 of the discs. You will want:
      Two x "2" (*), Three x "3" (**), Three x "4" (**), Three x "5" (****),
      Three x "6" (*****), Three x "8" (*****), Three x "9" (****),
      Three x "10" (****), Three x "11" (**), Two x "12" (*).
      The stars do not have to be painted, but they indicate how many possible rolls of two dice would lead to that outcome.

   b. 11 Discs should be written as conference chits.
      They should be written as follows:
      Two x “Time 3:1”   Two x “Ideas 3:1”   Two x “Grants 3:1”

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7 For example: [http://www.amazon.com/Avery%C2%AE-Full-Sheet-Printers-TrueBlock-Technology/dp/B000093L1J](http://www.amazon.com/Avery%C2%AE-Full-Sheet-Printers-TrueBlock-Technology/dp/B000093L1J)
8 For example: [http://www.amazon.com/Grafix-Chipboard-12-Inch-Natural-25-Pack/dp/B0013JRFUA](http://www.amazon.com/Grafix-Chipboard-12-Inch-Natural-25-Pack/dp/B0013JRFUA)
Two x “Grad Students 3:1”  Two x “Citations 3:1”  and One x “3:1”

5. You will need some sort of tokens to represent the experiments, papers, and books. Experiments, Papers, and Books should be in six colors for the six different players.

a. For Experiments, purchase square dowels, approximately ¼ inch on a side. You will need at least 90 total inches of dowel. Using a small wood cutter or a small wood saw, cut the dowel into pieces approximately 1 inch in length. Paint 15 dowel pieces in each of six colors: Blue, White, Red, Orange, Green, and Brown.11

b. Option: We purchased tokens that were pre-made to resemble Papers and Books.12 They still need to be painted for player colors other than brown.

6. Optional – Playing surface – A usual Catan set comes with a frame so that all the hexagons will stay in place during play. This set does not have a frame, but there is another way to make a stable playing surface. Buy a piece of felt at least 20” by 20”. Squares 36” by 36” are commonly sold.13

Then, on the bottoms of all hexagons (and possibly on the bottoms of the circular conference chits as well) attach pieces of Velcro. (The hooks, not the loops.) Velcro can be bought with a sticky back.14

11 Pre-cut pieces can be purchased at http://www.meeplesource.com/proddetail.php?prod=Wood but will still need to be repainted.
13 Such as http://www.amazon.com/Sax-Synthetic-Decorator-Kelly-Green/dp/B0042SUKCE
14 For example http://www.amazon.com/gp/product/B001ASD850