

## Game 39 – Engineering Projects

For an engineering class, six students—Fernando, Gus, Holly, Ona, Pei and Timothy, will work in pairs of two on a series of projects. Each project will result with the pair building one of three things—a model airplane, a steam engine, or a vehicle chassis. The engineering projects must be consistent with the following conditions:

If Fernando and Holly work together, they build a steam engine.

If Gus works with anyone, the two of them build a vehicle chassis.

If Ona works with either Timothy or Holly, the two of them build a steam engine; otherwise, whoever works with Ona builds a model airplane.

No engineering student works with the same fellow engineering student on two consecutive projects.

1. If during an immediately preceding project, Timothy built a model airplane with Fernando, which one of the following could be true?
  - A. During the preceding project, Pei built a steam engine with Holly.
  - B. During the preceding project, Pei built a model airplane with Holly.
  - C. Holly can partner with either Gus or Ona for the current project.
  - D. Ona can partner with either Pei or Holly for the current project.
  - E. Pei can partner with either Fernando or Gus for the current project.
2. If after the first project, the engineering students have built two model airplanes, which one of the following must be true?
  - A. Either Fernando or Holly worked with Gus.
  - B. Either Timothy or Holly worked with Gus.
  - C. Either Holly or Ona worked with Pei.
  - D. Either Fernando or Pei worked with Ona.
  - E. Either Fernando or Pei worked with Gus.
3. Which one of the following must be true?
  - A. If Gus works with Pei, at least one steam engine will be built.
  - B. If Ona works with Timothy, no model airplanes will be built.
  - C. If Timothy works with Holly, at most one steam engine will be built.
  - D. Pei cannot work with Ona.
  - E. Ona cannot work with Fernando.
4. If after two rounds of projects, the engineering students have not built any steam engines, which one of the following must be true?
  - A. Either Holly or Pei or both have built at least one vehicle chassis.
  - B. Either Timothy or Holly or both have built at least one model airplane.
  - C. Either Timothy or Holly or both have built at least one vehicle chassis.
  - D. Either Timothy or Fernando or have both built at least one vehicle chassis.
  - E. Either Pei or Fernando or both have built at least one vehicle chassis.
5. Which one of the following could be a complete and accurate list of things that could be built by the engineering students after each has completed two projects?
  - A. Four steam engines, one vehicle chassis, one model airplane
  - B. Three steam engines, one vehicle chassis, two model airplanes
  - C. Five vehicle chassis, one model airplanes
  - D. Four model airplanes, two vehicle chassis
  - E. Six model airplanes
6. If the students build the maximum number of steam engines over the course of three projects per student, each of the following could be true EXCEPT
  - A. Holly partners with Gus exactly once.
  - B. Ona partners with Pei exactly once.
  - C. Fernando partners with Gus exactly twice.
  - D. Fernando partners with Holly exactly once.
  - E. Holly partners with Pei exactly twice.

## Game 39 – Engineering Projects

1. E
2. D
3. C
4. C
5. D
6. B

This is a time conversion game. Solving it requires predicting and backtracking. One of the keys to solving this game is understanding the Ona rule. Remember that while Ona must build either a model airplane or a steam engine, depending on who she works with, and while Gus must build a vehicle chassis, the other two can build anything.

For Question 1, Ona can't be with Gus, because Gus has to build a vehicle chassis, and Ona never builds a vehicle chassis. Therefore, Gus had to either be with Holly or Pei on the preceding project, as did Ona. This excludes the four wrong answers (the third because Holly can't partner with either Gus or Ona since she partnered with one of them last time, and likewise for the fourth answer).

On Question 2, since two model airplanes were built, you can deduce that Holly and Timothy didn't work with Ona. This means they either worked together or one of them worked with Gus (you don't know which). Either way, this leaves Fernando or Pei to work with Ona, since Gus can't work with Ona given the inference from each's rule.

Question 3 involves the deduction that Holly and Timothy can't work with Ona; thus, Ona is building a model airplane, and whoever is working with Gus is building a vehicle chassis. For Question 4, you can deduce that neither Holly nor Timothy worked with Ona for two projects in a row. This means one of them had to work with Gus at least once, meaning they built a vehicle chassis.

Question 5 is a matter of excluding answers, but doing so takes some inferences. For example, Gus builds a vehicle chassis every time, so there must be at least two vehicle chassis. This leaves two answers remaining. After this, C can be excluded because Ona must build either a steam engine or a model airplane.

On Question 6, if the engineering students are to produce the maximum number of steam engines, then Ona and whoever partners with Ona must build one each time. This means Ona must partner with Timothy and then with Holly or vice versa.