

1. Environment Canada is responsible for collecting weather data across Canada and sharing that data with other meteorologists (like The Weather Network, or news stations). Interestingly, many forecasts differ in their predictions even though they share the same data. Meteorologists use a mathematical model; which is a computer program that helps predict future weather conditions through complex calculations. This is used to simulate what the atmospheric conditions will be over the next several days.

Weather is an example of what is called a mathematically chaotic system. A chaotic system is one where the slightest change in initial conditions can result in drastically different outcomes. Take the weather for example, forecasts could be based on specific temperature and pressure readings, but in the time it takes to execute the simulation the pressure could have changed slightly so it could have rained instead of just being a cloudy day.

To try and account for this meteorologists will run many computer simulations and change the initial conditions each time. Then they analyze and compile the results of all the simulations into the forecast.

Which of the following best describes why forecasts can differ even if they have the same starting data?

- a) Weather is a chaotic system.
 - b) Different forecasters use slightly different mathematical models.
 - c) Some forecasters have computing errors in their computer code.
 - d) Only forecasters with Environment Canada are properly trained.
2. **One morning the weather forecast calls for a 70% chance of rain. How was that number most likely determined? .**
- a) All the meteorologists call each other to determine the value.
 - b) 70 out of every 100 meteorologists think it might rain.
 - c) 70 out of 100 of the day's dates in the past had rain (i.e. if today is April 25 then 70/100 past April 25ths had rain)
 - d) 70 out of every 100 forecast models simulated by a meteorologist resulted in rain.
3. You checked the long term forecast for a day and wrote down what the weather was supposed to be like seven days from then; and when that day came a week later the weather was completely different than what you had written down!

What is the best reason why the seventh day of the forecast could be so different?

- a) Weather is a chaotic system.
- b) The computer models used by the meteorologist performed incorrect calculations.
- c) The meteorologist entered the incorrect data to begin with.
- d) Meteorologists don't fully understand how atmospheric conditions create our weather.

4. For drinks during the day, Paul has a cup of hot coffee, at a temperature of about 90°C , and a cup of cold mineral water, with a temperature of about 5°C . The cups are identical type and size and the volume of each drink is the same. The cups are left sitting in a room where the temperature is about 20°C .

What are the temperatures of the coffee and the mineral water likely to be after 10 minutes?

- a) 70°C and 10°C b) 90°C and 5°C c) 70°C and 25°C d) 20°C and 20°C

5. There are many types of pox viruses that cause pox diseases in animals. Each type of virus usually infects only one animal species. A magazine has reported that a scientist has used genetic engineering to modify the DNA of mousepox. The altered virus will kill all the mice it infects.

The scientist says research on modifying viruses is necessary in order to control pests that damage human food. Critics of the research say viruses could escape from laboratories and infect other animal species, especially humans.

Humans are infected with a pox virus called smallpox. Smallpox kills most people it infects. While it is thought that this disease has been eliminated from the general population, smallpox virus samples are kept in laboratories around the world.

Critics have expressed concern that the mousepox virus could infect species other than mice. Which one of the following reasons is the best explanation for this concern?

- a) The genes of smallpox virus and the genes of modified mousepox virus are identical.
 b) A mutation in mousepox DNA might allow the virus to infect other animals.
 c) A mutation could make the mousepox DNA identical to smallpox DNA.
 d) The number of genes in mousepox virus is the same as in other pox viruses.
6. A person who criticised the research was worried that the modified mousepox virus might escape from a laboratory. This virus could cause the extinction of some mice.

Which of the following outcomes are likely if some species of mice became extinct?

I Some food chains could be affected.

II Domestic cats could die for lack of food.

III Plants whose seeds are eaten by mice could temporarily increase in number.

- a) I only b) II and III only c) I and III only d) II only

7. Many people believe that wind should replace oil and coal as a source of energy for producing electricity. The structures in the picture below are windmills with blades that are rotated by the wind. These rotations produce electricity through generators that are turned by the windmills.

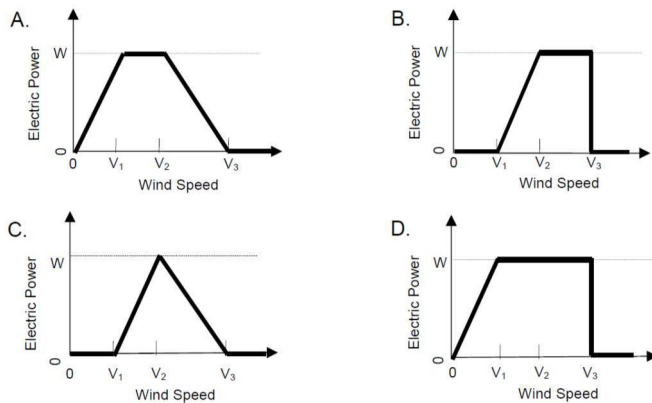


A wind farm

The stronger the wind, the faster the windmill blades rotate and the greater the electric power output. However, there is not a direct relationship between wind speed and electric power in a real setting. Below are four working conditions of electricity generation in a real wind farm.

- The windmill blades start rotating when the wind speed reaches V_1 .
- The electric power output reaches a maximum (W) when the wind speed is V_2 .
- For safety reasons, the blades are prevented from rotating faster than they do when the wind speed is V_2 .
- The blades stop rotating when the wind reaches V_3 .

Which one of the following graphs best represents the relationship between wind speed and electric power output under these working conditions?



- a) A b) B c) C d) D

8. Tobacco is smoked in cigarettes, cigars, and pipes. Research shows that tobacco-related diseases kill nearly 13500 people world wide every day. It is predicted that, by 2020, tobacco-related diseases will cause 12% of all deaths globally. Tobacco smoke contains many harmful substances. The most damaging substances are tar, nicotine, and carbon monoxide.

When tobacco smoke is inhaled into the lungs tar from the smoke is deposited in the lungs and this prevents the lungs from absorbing oxygen and that oxygen cannot be transferred to the blood stream. Nicotine is an addictive chemical absorbed in to the body that can lead to unhealthy physical appearance changes and defects in unborn babies. Carbon Monoxide is a poisonous gas that cannot be detected by the human senses.

Which one of the following is a function of the lungs?

- a) To pump oxygenated blood to all parts of your body.
- b) TO transfer some of the oxygen that you breathe to your blood.
- c) To purify your blood by reducing the carbon dioxide.
- d) To convert carbon dioxide molecules into oxygen molecules.

9. Tobacco smoking increases the risk of getting lung cancer and some other diseases. Three diseases are listed below.

I Bronchitis

II HIV/AIDS

III Chicken Pox

Which of the above diseases are you more likely to contract because of smoking?

- a) I only b) II only c) III only d) All listed diseases

10. Some people use nicotine patches to help them to give up smoking. The patches are put on the skin and release nicotine into the blood. This helps to relieve cravings and withdrawal symptoms when people have stopped smoking. To study the effectiveness of nicotine patches, a group of 100 smokers who want to give up smoking is chosen randomly. The group is to be studied for six months. The effectiveness of the patches is to be measured by finding out how many people in the group have not resumed smoking by the end of the study.

Which one of the following is the best experimental design?

- a) All the people in the group wear patches.
b) All wear patches except one person who tries to give up smoking without them.
c) People choose whether or not they will use patches to help give up smoking.
d) Half are randomly chosen to use patches and the other half do not use them.