Astronaut Ice Cream, Anyone reading passage

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A technique for astronauts that can help to provide food is known as Breeze-drying. However, it can also be used for other situations.

A. Freeze-drying treats food like a suspended animation: you can easily keep a freeze-dried meal for an indefinite time, and when you're ready to consume, you can simply have it. With some hot water, you can rejuvenate it completely. The primal foodstuff will remain unchanged even after various years.

B. In this method, water is fully removed from the item but the rest of the item remains virtually unspoiled. To conserve the food or to lessen its weight is the primary reason for doing it. Microorganisms like bacteria that cause spoilage can be kept away if we remove the water completely from the food. Likewise, removing water also prevents ripening because without water the enzymes cannot cause ripening which occurs naturally in the food.

C. As most food is made up of water, the weight is significantly reduced by Freeze-drying; for instance, water percentage is 80-100% more in many fruits. Transportation would be less difficult if we remove the water as this makes the food much lighter. Freeze-dried food is carried by the military and camping-supply companies because it is easier for them to carry individually. Due to cramped headquarters on board spacecraft, NASA also has freeze-dried foods.

D. Many materials such as Pharmaceuticals can be stored using this method. Freeze-drying the material and storing it aside in a container lacking both oxygen and water can help chemists to expand the pharmaceutical shelf vividly. In the same way, freeze-drying can possibly be used by researchers to preserve biological samples. By using this process we can even prevent things from water damage such as esteemed manuscripts.

E. Freeze-drying differs from uncomplicated drying as it can remove almost all of the water from materials, whereas simple drying processes can only remove 90-95 percent. This means that, rather than just slowing down the harm caused by bacteria and enzymes, the damage can be essentially prevented instead. Furthermore, because the material's composition and structure are not considerably altered, it can be revitalised without jeopardising its original quality.

F. This is feasible because during freeze-drying, solid water - ice - is converted directly into water vapour, bypassing the liquid phase entirely. This is called 'sublimation' in which the solid substance shifts directly into gas.Sublimation occurs when a molecule gets enough energy to break out from the molecules around it, similar to evaporation. When the molecules in water have enough energy to break free but the conditions aren't right for a liquid to form, it will sublimate from a solid (ice) to a gas (vapour). These conditions are determined by heat and atmospheric pressure.When the temperature is above the freezing point so that the ice can

thaw however the atmospheric pressure is too low for a liquid to form (below 0.06 atmospheres (ATM)) then the substance forms a gas.

G. This is the underlying principle of freeze-drying equipment .The freeze-drying chamber is coupled to a freezing coil and refrigerator compressor in result it preserves the material. The temperature inside the chamber reduces as the chamber seals off. As the material is frozen in the solid form, the water is separated from everything around on a molecular level, even though the water is still present. Next, the chamber's ambient pressure is then reduced to 0.06 ATM by a vacuum pump which forces air out of the chamber The heating units apply a modest quantity of heat to the chamber's shelves which causes the ice to undergo a phase shift. The ice directly transforms into water vapour since the pressure in the chamber is too low.Following this the water vapour then leaves the freeze-drying chamber and flows past the freezing coil. The water vapour condenses onto the freezing coil in the form of solid ice, in the same way that water condenses as frost on a cold day.

H. The process continues for several hours (even days) while the material gradually dries out. This time period is required to avoid overheating, which might compromise the material's structure. It is packed in a moisture-free package once it has dried sufficiently. The material can lie on a shelf for years and years without degrading if the box is secure, until it is returned to its forma form with a little hot water. If everything goes according to the plan, the material will make it through the entire process almost undamaged.

I. In fact, the notion of freeze-drying as a general concept is not new but has been around for centuries. The mountain peaks along the Andes as natural was used by the ancient Incas of Peru as natural food preservers. The extremely cold temperatures and low pressure at those high elevations prevented food from spoiling in the same general way as the contemporary freeze-drying equipment and a freezer.

Astronaut Ice Cream, Anyone reading questions

Questions (1 - 5)

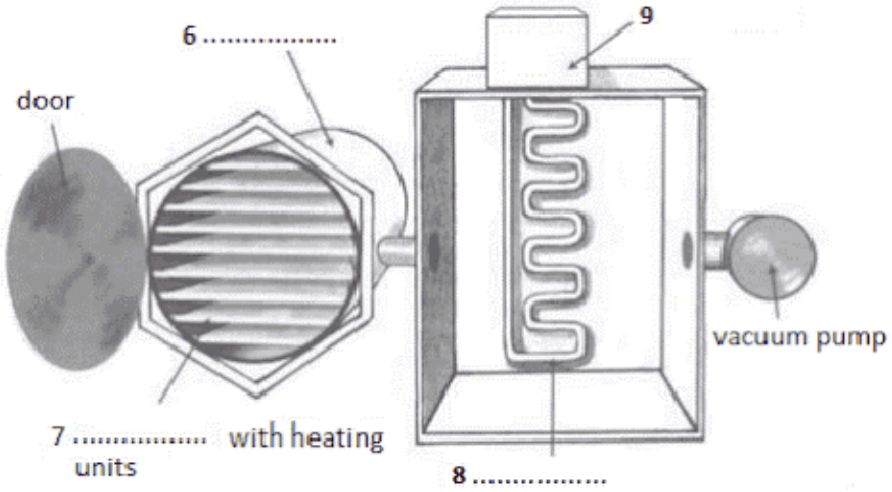
Complete the notes below. Choose NO MORE THAN THREE WORDS from the passage for each answer.

Uses of freeze-drying:

• food preservation
• easy (1) _____ of food items
• long-term storage of (2) _____ and biological samples
• preservation of precious (3) _____
Freeze-drying
• is based on the process of (4) _____ is more efficient than (5) _____

Questions (6 - 9)

Label the diagram below. Choose NO MORE THAN TWO WORDS from the passage for each answer.
Write your answers in boxes 6-9 on your answer sheet.



Questions (10 - 13)

Complete the summary below.
Choose NO MORE THAN THREE WORDS AND/OR A NUMBER from the passage for each answer.
Write your answers in boxes 10-13 on your answer sheet.

Freeze-drying prevents food from going bad by stopping the activity of microorganisms or (10) _____ Its advantages are that the food tastes and feels the same as the original because both the (11) _____ and structure are preserved. The process is carried out slowly in order to ensure that (12) _____ does not take place. The people of one ancient mountain civilization were able to use this method of food preservation because the conditions needed were present at (13) _____