Drying by Design Pre/Post Test

Directions: For each of the following questions, select the best answer and *record it on the answer sheet provided.*

1. When solving a design problem, the solution is always limited by ____
   (a) web-based information downloading limitations
   (b) the prescribed approach to the design solution.
   (c) problem constraints and specifications.
   (d) the availability of examples of prior solutions.

2. An informed design cycle is a process that ____
   (a) solves design problems in a single cycle without repeating.
   (b) uses knowledge of mathematics, science and technology to enhance the design solution.
   (c) uses a series of mathematical formulae to arrive at a single correct solution for the design.
   (d) relies on a series of trial-and-error problem-solving procedures.

3. The most important reason to dry food is to _____
   (a) increase its caloric content.
   (b) reduce the likelihood of spoilage.
   (c) maintain its natural color.
   (d) improve its nutritional value.

4. To ensure effective food dehydration, ____
   (a) the drying must be slow to allow the moisture to evaporate.
   (b) the drying temperature must be kept high to cook the outermost surface.
   (c) very humid air must be blown across the food surface.
   (d) temperatures over 120^0 Celsius must be used to initiate the evaporation.

5. A fan is usually helpful in accelerating the food drying process because it ____
   (a) decreases the moisture migration inside the food
   (b) increases the temperature of the food surface
   (c) decreases the relative humidity near the food surface
   (d) increases the relative humidity near the food surface

6. Food dehydration will be best if the relative humidity of the surrounding air is
   (a) higher than the air at the food surface
   (b) equal to the air at the food surface
   (c) lower than the air at the food surface
   (d) varied with the rate of dehydration

7. When investigating the relationships between the thickness of the food slices and the time it takes to dry them, the___
   (a) drying time is the independent variable and thickness is the dependent variable.
   (b) drying time is the dependent variable and thickness is the independent variable.
   (c) drying time and thickness are both dependent variables.
   (d) drying time and thickness can be both dependent and independent variables.

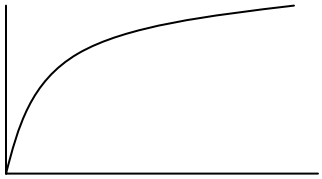
The table below contains data from an investigation done by a student who worked on the "Drying By Design" module:

Experiment #	Average thickness of apple slices, in mm	Drying time, in minutes
1	4	25
2	10	60
3	16	85
4	20	102
5	25	120
6	30	130
7	36	135

8. Describe the results in an appropriate graph on the answer sheet.
9. Describe the relationship between the slice thickness and the drying time on the answer sheet.

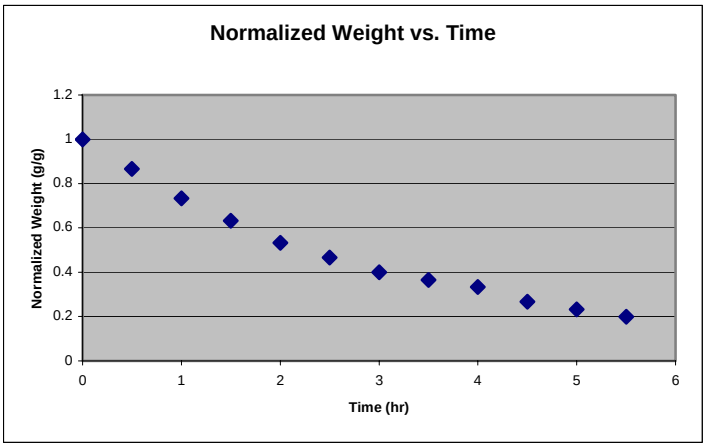
10. What is humidity?
    (a) maximum amount of heat in the air
    (b) the air temperature
    (c) the pressure that the air exerts on a body
    (d) the amount of water vapor in the air

11. What factor is important for the proper drying of food?
    (a) temperature
    (b) humidity
    (c) air flow
    (d) all of the above

12. 

The graph above shows what type of relationship?

(a) linear
(b) non-linear
(c) skewed
(d) independent



13. The graph above is a normalized plot of ¼-inch banana slices. How much time did it take to dry the banana slices to 60% of the initial weight?

Three apple slices are to be placed on a rectangular drying rack that is 8 cm X 12 cm. The apple slices have diameters of 3 cm, 4 cm, and 5 cm.

14. Calculate the area of *each* apple slice.
15. Calculate the area of the drying rack.
16. Will the apple slices "fit" on the drying rack? Justify your answer.

17. The *maximum* amount of water vapor that air can hold in a warm, moist tropical region is approximately 30 grams/kilogram (that is, 30 grams of water vapor per kilogram of air). If the

relative humidity in this region is 75% on a given day, what is the amount of water vapor in the air that day?

18. A regular hexagon (all 6 sides the same length) has a side **s** of 10 mm. What would be the approximate diameter of a circle that has the same area as the hexagon?
(Area of circle = πr^2; Area of hexagon = $2.6\mathbf{s}^2$)

(a) 10 mm
(b) 83 mm
(c) 9 mm
(d) 18 mm

19. A rectangular drying surface for an apple dehydrator is 10 cm X 15 cm. Five apple slices have a total area of 120 cm^2. What percentage of the drying surface will the five apple slices occupy?

20. Under which condition will evaporation of water from damp clothes be fastest?

(a) cold day with high humidity
(b) cold day with low humidity
(c) warm day with high humidity
(d) warm day with low humidity

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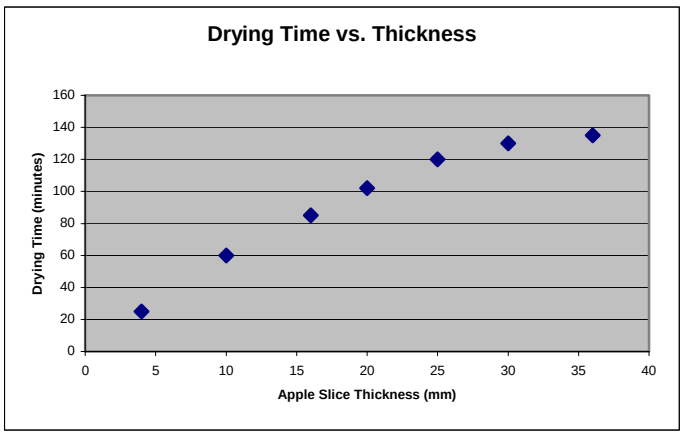
Answer Key

1. c
2. b
3. b
4. a
5. c
6. c
7. b

8.

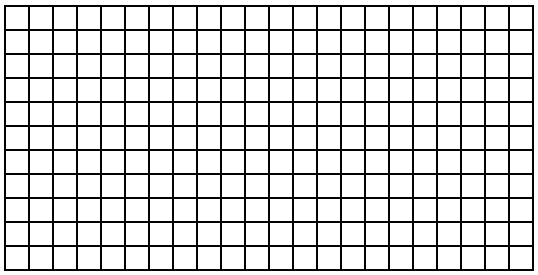


9. Time to dry the apple slices increases with increasing apple thickness, but at a decreasing rate. As the apple slices get thicker than ~25 mm, the time it takes to dry them doesn't change very much. This is a non-linear relationship.
10. d
11. d
12. b
13. @ normalized weight = 0.6 (60%), it took about 1 ½ hours to dry the banana slices.
14. Assuming round slices:
    Area of 3 cm diameter slice = π x $(1\ ½)^2$ = 7.1 cm^2
    Area of 4 cm diameter slice = π x $(2)^2$ = 12. 6 cm^2
    Area of 5 cm diameter slice = π x $(2\ ½)^2$ = 19.6 cm^2

15. Area of drying rack = 8 x 12 = 96 cm^2
16. Yes, 3 apple slices will fit. (area of apple slices = 39.3 square centimeters, far less than the 96 square centimeters of area of the rack. (This can be shown visually as well, with the 3 circles and the rectangular rack.)
17. Amount of water vapor in air = 75% of 30 = 0.75 x 30 = 22.5 grams/kilogram
18. d
19. % of drying surface = (120/150) x 100 = 80%
20. d

Name: _____

Drying by Design Pre/Post Test Student Answer Sheet

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. 
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