Station I

1. Convert 12.74 kilograms to grams.

12,740 grams (g)

2. 1 millimeter equals __**1000**__ micrometers.

3. 15,000 square centimeters equals __**.015**__ square decameters.

4. How many cubic centimeters are in 2.4 liters?

2,400 cubic centimeters (cm^3)

5. How many grams are in 1.4 tonnes?

1,400,000 grams (g)

6. The formulas for the surface area and volume of a sphere are $4 \bullet \pi \bullet r^2$ and $(4/3) \bullet \pi \bullet r^3$ respectively. If a sphere has a surface area of 36π cm^2, what is its volume in terms of pi?

36π cubic centimeters (cm^3)

7. A cubic meter of a substance has a mass of 2.5 tonnes. What is its density in grams per cubic centimeter?

2.5 grams per cubic centimeter (g/cm^3)

8. 1 meter per second is equal to __**3.6**__ kilometers per hour.

Station II

Use the table below to answer questions 9-16.

Food	Serving Size	Calories per Serving	Sugar per Serving (g)
A	2oz	80	7
B	6oz	260	18
C	8oz	310	20
D	4oz	160	12
E	6oz	295	25
F	3oz	110	10

9. Which food has the least amount of calories per ounce?

Food F

10. Which food has the greatest amount of calories per ounce?

Food E

11. Which two foods have the same amount of calories per ounce?

Food A and Food D

12. Which food has the greatest amount of sugar per ounce?

Food E

13. Which two foods have the same amount of sugar per ounce?

Food B and Food D

14. Which food has the least amount of sugar per ounce?

Food C

15. How much sugar would 9 ounces of Food E contain?

37.5 grams

16. Which food should you consume if you want to consume 9 ounces of food, between 350 and 380 calories, and less than 30 grams of sugar? **Food D**

Station III

17. The use of senses, sometimes involving the use of instruments and the recording of data is called _**observation**_.

18. A logical interpretation based on what is known or assumed to be true is called a(n) _**inference**_.

19. An explanation for an observed phenomenon is called a(n) _**hypothesis**_.

20. In a controlled experiment, the _**dependent**_ variable (usually) responds to changes in the independent variable.

21. Information gathered from observations is called _**data**_.

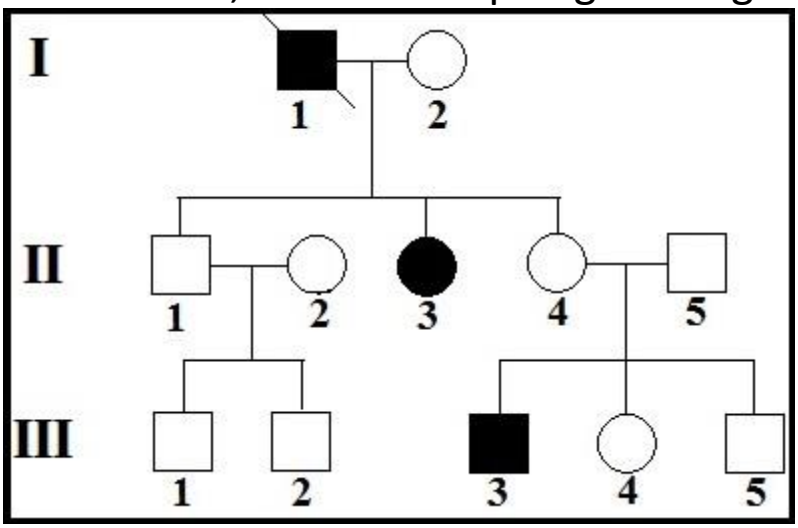
22. The use of scientific instruments in observation yields _**quantitative**_ data.

TB 1: What is a scientific theory? How does a law differ from a theory?

A scientific theory is a well-substantiated explanation of some aspect of the natural world that is acquired through the scientific method and repeatedly tested and confirmed through observation and experimentation. Laws differ from scientific theories in that they do not posit a mechanism or explanation of phenomena: they are merely distillations of the results of repeated observation.

Station IV

For questions 23-28, refer to the pedigree diagram below.



23. Which individuals are affected by this genetic disorder?

I-1, II-3, and III-3

24. What is the relationship between individuals I-1 and III-2?

Grandfather/grandson

25. Is this genetic disorder caused by dominant or recessive alleles?

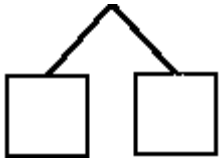
Recessive alleles (individuals II-4 and II-5 are not affected by it, but one of their offspring is)

26. Is individual I-2 homozygous or heterozygous?

Heterozygous (Can't be homozygous dominant, or else the disorder wouldn't be passed to their offspring; can't be homozygous recessive or they would have the disorder)

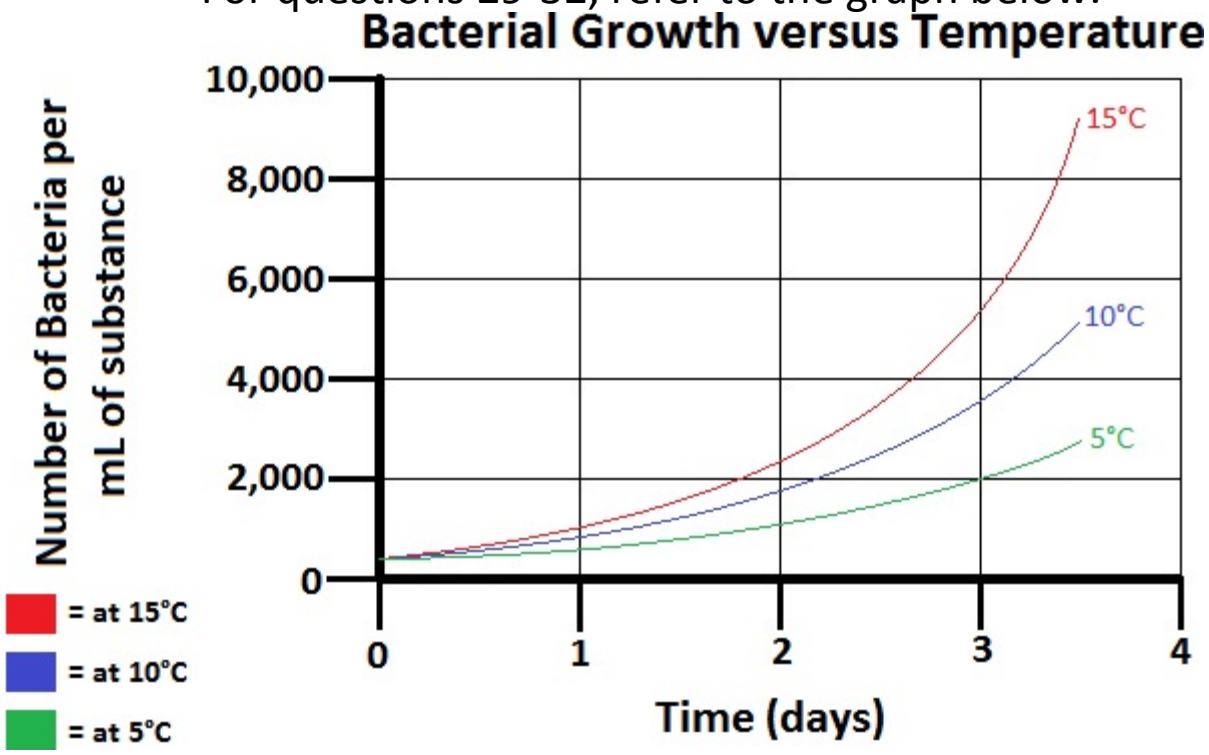
27. Draw a symbol that represents a carrier of a sex-linked recessive disorder.

28. Draw a symbol that would represent male dizygotic twins.



Station V

For questions 29-32, refer to the graph below.



29. After 1 day at 15°C, how many bacteria were there per milliliter of the substance?

1,000 bacteria per milliliter

30. You have a 47.5 milliliter sample of the substance stored at 5°C. After 3 days, how many bacteria are in the entire sample?

95,000 bacteria

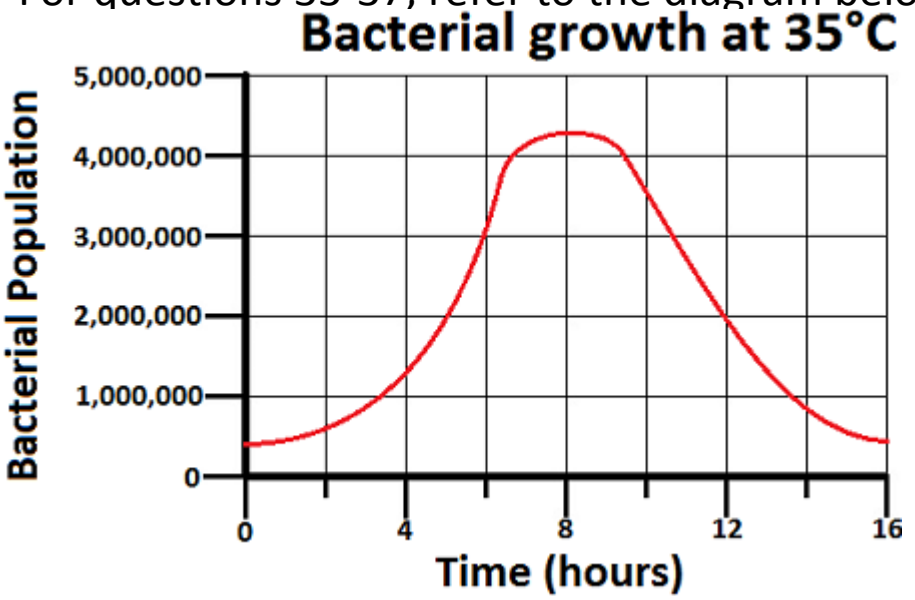
31. In all 3 of these samples, the bacteria exhibit an _**exponential**_ _**growth**_ curve.

32. What is the independent variable of this experiment?

Temperature

Station VI

For questions 33-37, refer to the diagram below.



33. Between which of the following times did the number of bacteria increase the most?
    a) Hours 2 and 4
    b) Hours 3 and 5
    c) Hours 4 and 6
    d) Hours 5 and 7
    e) Hours 6 and 8

34. Which is the most likely reason for the decrease in the bacterial population after hour 8?
    f) The temperature was too high for the bacterial culture after 8 hours
    g) The bacteria stopped reproducing after 8 hours
    h) More nutrients were added to the culture at regular intervals
    i) Bacterial waste products accumulated in the nutrient solution

35. After how many hours did the bacterial population initially reach 2,000,000?

5 hours

36. What was the bacterial population at hour 8?

Accept any value within the range of 4,200,000 and 4,350,000 bacteria

37. If data collection on the bacterial culture started Thursday at 7:00 P.M., when was the last data that is displayed on the graph collected?

11:00 A.M. Friday

Station VII

Data set 1							
12	14	5	13	10	18	13	9

Data set 2					
103.2	115.2	91.4	108.2	100.0	95.8

38. What is the range of Data set 1?

13 18-5=13

39. What is the mean of Data set 1?

11.75 (12+14+5+13+10+18+13+9)/8=11.75

40. What is the median of Data set 1?

12.5 (8+1)/2=4.5 5 9 10 12 13 13 14 18
(12+13)/2=12.5

41. What is the mode of Data set 1?

13

42. What is the range of Data set 2?

23.8 115.2-91.4=23.8

43. What is the mean of Data set 2?

102.3
(103.2+115.2+91.4+108.2+100.0+95.8)/6=102.3

44. What is the median of Data set 2?

101.6 (6+1)/2=3.5 91.4 95.8 100.0 103.2 108.2 115.2
(100.0+103.2)/2=101.6

45. What is the mode of Data set 2?

No mode

Station VIII

For questions 46-51, refer to the diagram below.

46. What is the name of the scientific instrument depicted?

Graduated cylinder

47. The numbered increments are _**5**_ mL.

48. The unnumbered increments are _**0.5**_ mL.

49. What is the reading of the instrument for this solution in milliliters? In liters?

Part 1: Accept any response between 23.1 mL and 23.3 mL.

Part 2: Accept any response between 0.0231 L and 0.0233 L.

50. Describe how you could find the mass of the solution in the instrument.

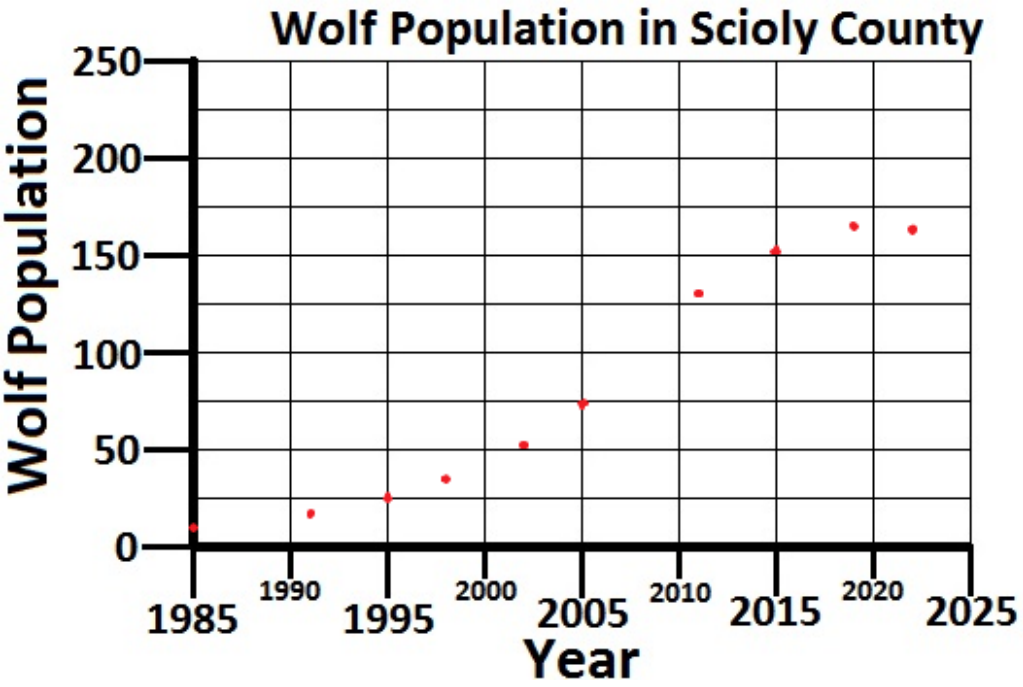
Answers may vary: Find the mass of the graduated cylinder with the solution. Empty and dry the graduated cylinder thoroughly. Find the mass of the empty graduated cylinder. Subtract the mass of the empty graduated cylinder from the mass of the graduated cylinder with the solution in it.

Accept any other reasonable responses.

51. Given that the mass of the solution in the instrument is 18.6 grams, what is the solution's density in g/mL? (Round to three decimal places)

Accept any responses between 0.798 g/mL and 0.805 g/mL (this corresponds to the accepted range in question 49)

Station IX



# of wolves	Year
10	1985
17	1991
25	1995
35	1998
52	2002
74	2005
130	2011
153	2015
165	2019
163	2022

52. Using the data table, complete the graph above. (Neatness of graph will serve as the 2nd tiebreaker)

53. In 2025, the wolf population was found to have dropped to 138. Given no other information, which of the following could possibly be the cause of this drop in population? (choose all that apply)
    - **a. Unfavorable environmental conditions**
    - **b. Human activity**
    - **c. Emigration of wolves out of the area**
    - **d. Disease**

54. From 1985 to 2015, the wolf population increased from 10 to 153 individuals. Assuming no movement of individuals into the area, which of the following occurrences are responsible for this population growth?
    - **e. There was a higher birth rate than death rate**
    - f. There was a higher death rate than birth rate
    - g. The birth rate was the same as the death rate

55. TB 3: Wolves in Scioly County have been often observed to prey upon rabbits. These rabbits obtain their energy by consuming various grasses. What are two terms that may be applied to the wolves based upon their position in this food chain? **Secondary/2nd order consumers and primary/1st order carnivores**

Station X

For questions 56-61, refer to the diagram to the right.

56. What is the name of the part indicated by number 3? What is its purpose?

Revolving nosepiece; it holds the objective lenses and allows for easy swapping between them

57. What is the number that indicates the part that would be used to adjust the amount of light reaching a specimen?

8

58. What is the name of the part indicated by number 9? Would this be used more at low powers or high powers?

Coarse adjustment knob; low powers

59. What is the name of the part indicated by number 1? What is its purpose?

Ocular (lens); it magnifies the image produced by the objective lenses

60. What is the name of the part that holds a slide to the stage? What number indicates this part on the diagram?

Stage clips; 6

61. What number on the diagram indicates the arm? What is the purpose of the arm?

4; it supports the ocular, the body tube, and the revolving nosepiece (and therefore the objective lenses as well)

Station XI

62. You are viewing a slide of pond water under a compound light microscope when you spot an ostracod. Viewing it through the microscope, you see it move down, then right, and then up. If you were viewing this slide from above without a microscope, you would have seen that the ostracod actually moved **_up_**, then **_left_**, and then **_down_**.

63. Earlier you measured the diameter of the field of view under the 4x objective lens to be 3.8 millimeters. You are now viewing the ostracod under the 10x objective lens. Your microscope has a 10x ocular lens.

    a. What is the diameter of the field of view under the 10x objective lens in millimeters? In micrometers? (circle both final answers)

$\frac{100}{40} = \frac{3.8}{X}$ X= **1.52 mm** $1.52 \times 1{,}000 =$ **1520 µm**

    b. While viewing the ostracod under the 10x objective lens, you estimate that you could fit 3.2 ostracods (of the same size and shape as the one you are observing) lined up lengthwise across the center of the field of view. Based upon this estimate, what is the length of this of this ostracod in micrometers? (circle final answer)

$\text{Size of Object} = \frac{\text{Field of View}}{\text{Fit Number}}$ $\frac{1520}{3.2} =$ **475 µm**

    c. Using a stopwatch, you find that it took the ostracod 16.3 seconds to move across the diameter of the field of view (while still under the 10x objective lens). Knowing the diameter of the field of view, what was the ostracod's average velocity during that trial in micrometers per second? (circle final answer) (round to two decimal places)

$\frac{1520}{16.3} =$ **93.25 µm/s**