Practice Questions 1: Scientific Method

1.

DATA TABLE

Molts	Average Length of larvae (mm)			
	Group 1 (15°C)	Group 2 (20°C)	Group 3 (25°C)	Group 4 (30°C)
1	10.0	10.0	10.0	10.0
2	11.0	11.5	12.0	13.0
3	11.5	12.5	13.5	14.5
4	11.8	14.0	16.3	15.5

A student divided some insect larvae into four equal groups, each having the same amount of food. Each group was kept at a different temperature, and the average length of the larvae was determined after each shedding of the exoskeleton (molt). The data obtained are shown in the data table. According to the data, the most favorable temperature for total growth in these larvae is

A. 15°C
B. 20°C
C. 25°C
D. 30°C

2. Which laboratory equipment is correctly paired with a unit it measures?

A. metric ruler – centigrams
B. Celsius thermometer – degrees Fahrenheit
C. glass beaker – millimeters
D. graduated cylinder – milliliters

3.

Data Table	
Group	Solution Injected
X	1 mL adrenaline in distilled water
Y	1 mL glucose in distilled water
Z	1 mL distilled water, only

An investigation was conducted using three groups of laboratory rats, X, Y, and Z, to determine the relative effects of glucose and adrenaline on the rate of heartbeat. The experimental conditions for each group of rats were kept the same except for the type of solution injected, as shown in the data table. According to the data table, which group of rats functioned as the control?

A. X, only   B. Y, only   C. Z, only   D. both X and Y

4.
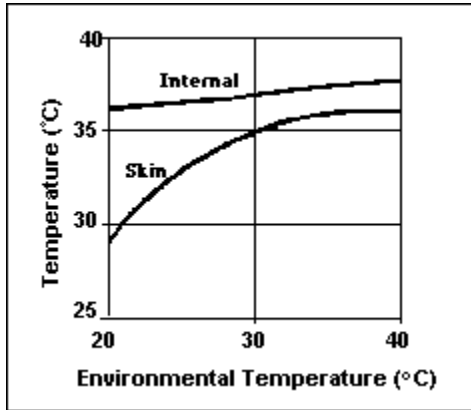
The graph shows the effect of environmental temperature on a girl's skin temperature and on her internal body temperature. Which statement best describes what happen as environmental temperature increases from 20°C to 30°C?

    A. Both the internal and the skin temperatures reach 40°C.
    B. Both the internal and the skin temperatures increase by about 7°C.
    C. The skin temperature decreases to about 30°C.
    D. The internal temperature increases by about 1°C.

5. If the leaves of a geranium plant receive an adequate supply of raw materials, which graph below shows how the rate of photosynthesis is related to increasing light intensity received by the plant?

   A.   B.   C.   D.
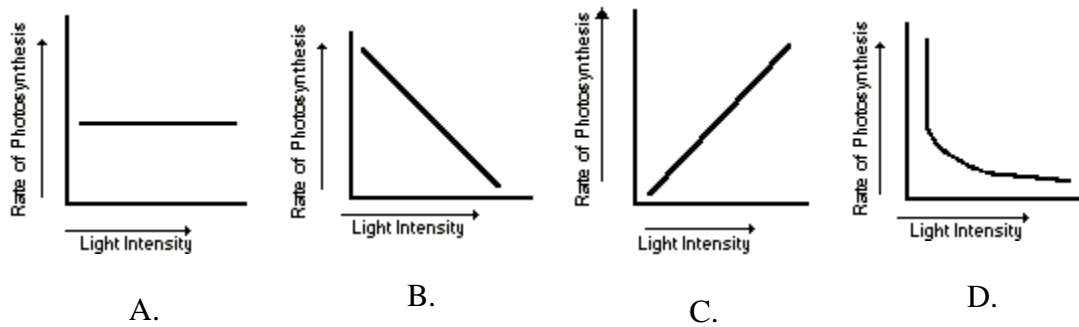
6. Base your answer to the question on the investigation described below and on your knowledge of biology.

A student cut a piece of potato into 8 cubes, each measuring 5 millimeters along each edge, and placed 7 of them in a beaker containing a 25% salt solution. One cube was removed from the beaker every 10 minutes for a period of 70 minutes and the average length of two sides was determined. The results are shown in the data table below.

Data Table	
Time	Average Length

| (min.)	(mm)
0	5.0
10	4.5
20	4.0
30	3.5
40	3.0
50	2.5
60	2.5
70	2.5

Which line graph below most accurately showns the relationship between time in the salt solution and size of the cube?

A.

C.

B.

D.
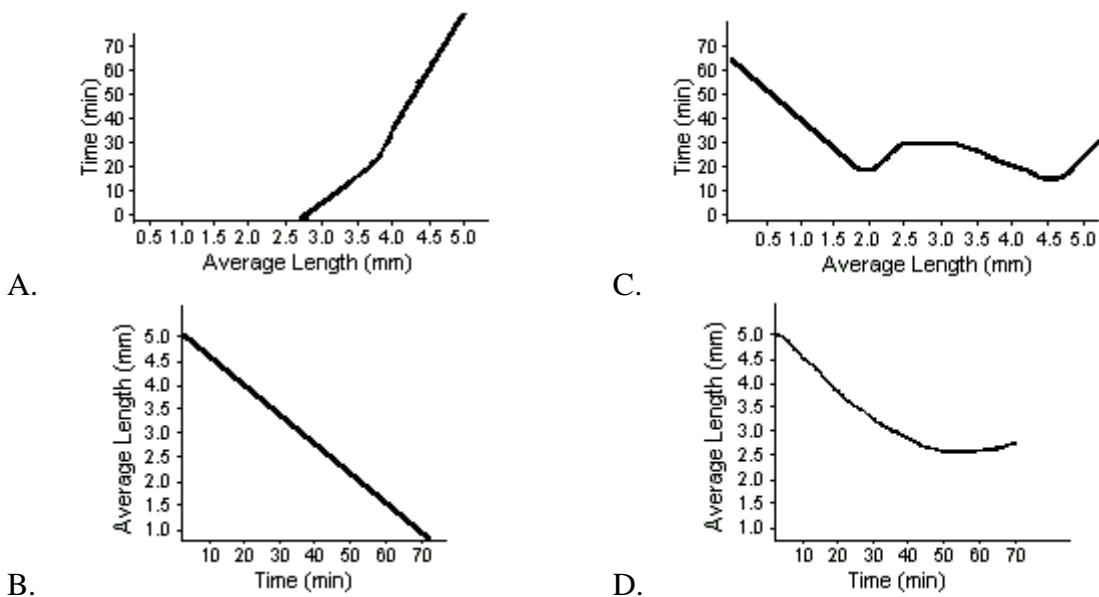
7. An organism was kept at a temperature of 40°C for a period of 2 weeks. At the end of that time, the investigator determined that the organism was sterile. To support the hypothesis that high temperatures cause sterility, the investigator should be able to show that the

    A. organism was not sterile before the experimental period began
    B. high temperature did not alter the blood pressure of the organism
    C. pituitary gland of the organism had not degenerated
    D. organism was homozygous for temperature sensitivity

8.
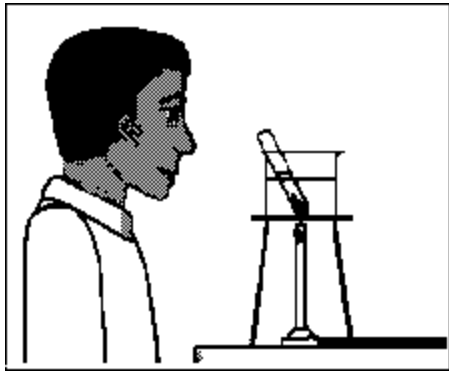
Base your answer on the diagram and on your knowledge of biology. Which statement describes two unsafe laboratory practices represented in the diagram?

    A. The flame is too high and the test tube is unstoppered
    B. The opening of the test tube is pointed toward the student and the student is not wearing goggles.
    C. The test tube is unstoppered and the student is not wearing goggles.
    D. The beaker has water in it and the flame is under the tripod.

9. When heating liquid materials in laboratory glassware, a student should always

    A. wear safety goggles
    B. use Benedict's solution
    C. stopper the test tube
    D. record the temperature of the liquid

10.

Twelve bean plants were used to study the effects of nutrients on the rate of plant growth. All the plants used in this investigation were initially the same height. Starting on day 1, six of the bean plants (Group A) were given 30 milliliters of distilled water every day for seven consecutive days. Starting on the same day, the other six bean plants (Group B) were given 30 milliliters of distilled water containing 0.1 gram of fertilizer every day for seven consecutive days. The average daily change in height of the plants in each group is shown in the data table below.

DATA TABLE

Day	Average Daily Increase in Plant Height (mm)	
	Group A	Group B
1	0	0
2	2	4
3	1	3
4	3	5
5	2	5
6	2	4
7	1	4

Base your answer on the information in the graphic and your knowledge of biology.
A variable in this investigation was the

    A. number of bean plants in each group
    B. amount of water given daily to each plant
    C. initial height of each bean plant
    D. amount of nutrient fed to each group of bean plants

11.

Twelve bean plants were used to study the effects of nutrients on the rate of plant growth. All the plants used in this investigation were initially the same height. Starting on day 1, six of the bean plants (Group A) were given 30 milliliters of distilled water every day for seven consecutive days. Starting on the same day, the other six bean plants (Group B) were given 30 milliliters of distilled water containing 0.1 gram of fertilizer every day for seven consecutive days. The average daily change in height of the plants in each group is shown in the data table below.

DATA TABLE

Day	Average Daily Increase in Plant Height (mm)	
	Group A	Group B
1	0	0
2	2	4
3	1	3
4	3	5
5	2	5
6	2	4
7	1	4

Base your answer on the information in the graphic and your knowledge of biology.
Based on the data in the table, if all the bean plants were 70 millimeters tall on day 1, the average height of the bean plants in group B on day 7 would be

    A. 75 mm
    B. 81 mm
    C. 95 mm
    D. 100 mm

12.

An investigation was conducted to study the effect of airborne sulfur dioxide on the growth of two tree species. The radial growth (increase in the radius of a stem) of trees growing in a sulfur dioxide-free environment was compared with the radial growth of trees growing in environments with different concentrations of sulfur dioxide. Other environmental conditions were similar for both species. The average annual percent reduction in radial growth of the two species was recorded in the data table below.

Effect of SO$_2$ Concentration on Reduction in Tree Growth

| Annual SO$_2$ Concentration ($\mu g/cm^3$)	Average Annual Percent Reduction in Radial Growth	
	Scotch Pine	Common Oak
0.00	0	0
0.05	8	18
0.10	52	35
0.15	97	50

Base your answer on the investigation described, the data table shown in the graphic and on your knowledge of biology. Based on the data in the graphic, a sulfur dioxide concentration of 0.10 micrograms per cubic meter will result in a percent of growth reduction that is

    A. greater in common oak than in scotch pine
    B. equal in common oak and scotch pine
    C. at a minimum for both common oak and scotch pine
    D. greater in scotch pine than in common oak

13. An investigation was set up to determine the effectiveness of a particular fertilizer on the growth of bean plants. In the investigation, each of the 10 bean plants in group A was watered with 50 milliliters of a solution of distilled water and fertilizer, while each of the 10 bean plants in group B was watered with 50 milliliters of distilled water only. Both groups of plants were watered every other day for 1 month and grown under identical environmental conditions. The control for this investigation was

    A. group A, only
    B. group B, only
    C. both group A and group B
    D. neither group A nor group B

14. Which diagram illustrates the safest method of heating a solution in a test tube? (Note: The student heating the tube is to the left of each diagram.)

    A.   B.   C.   D.
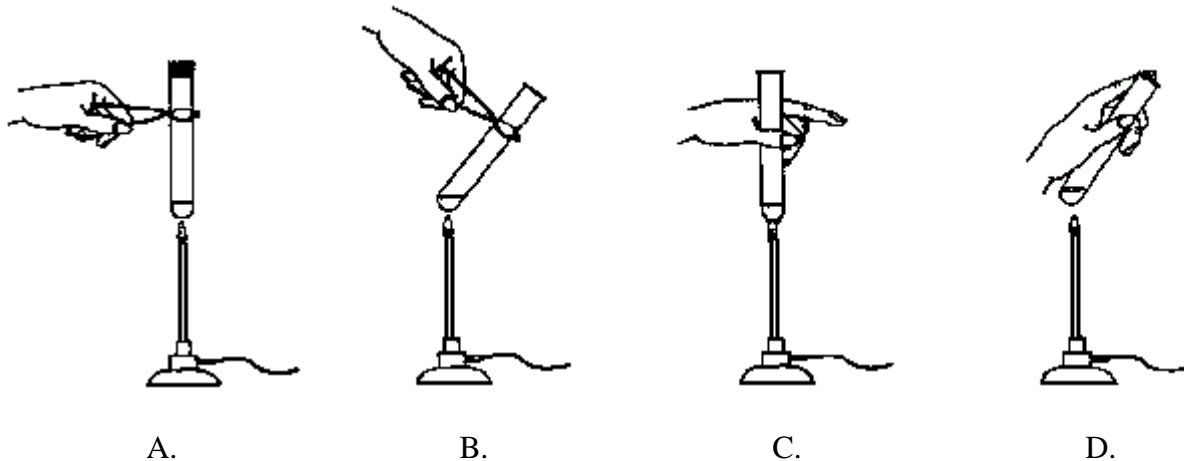
15. A new drug for the treatment of asthma is tested on 100 people. The people are evenly divided into two groups. One group is given the drug, and the other group is given a glucose pill. The group that is given the glucose pill serves as the

    A. experimental group
    B. limiting factor
   C. control
    D. indicator

16. A group of biology students extracted the photosynthetic pigments from spinach leaves using the solvent acetone. A spectrophotometer was used to measure the percent absorption of six different wavelengths of light by the extracted pigments. The wavelengths of light were measured in units known as nanometers (nm). One nanometer is equal to one billionth of a meter. The following data were collected:

- yellow light (585nm) – 25.8% absorption
- blue light (457nm) – 49.8% absorption
- orange light (616nm) – 32.1% absorption
- violet light (412nm) – 49.8% absorption
- red light (674nm) – 41.0% absorption
- green light (533nm) – 17.8% absorption

Which statement is a valid conclusion that can be drawn from the data obtained in the investigation?

A. Photosynthetic pigments in spinach plants absorb blue and violet light more efficiently than red light.
B. The data would be the same for all pigments in spinach plants.
C. Green and yellow light are not absorbed by spinach plants.
D. All plants are efficient at absorbing red and violet light.

17.
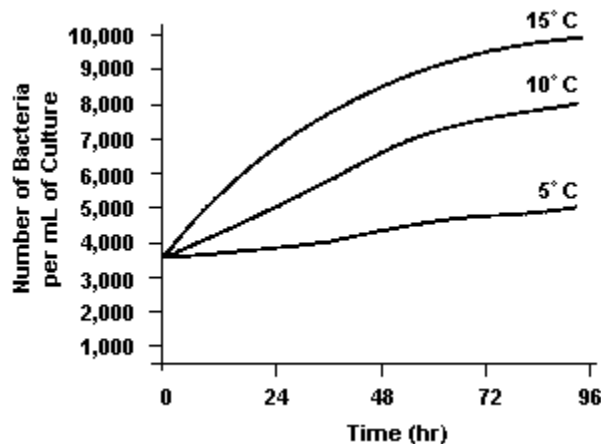
The graph represents the results of an investigation of the growth of three identical bacterial cultures incubated at different temperatures. Which inference can be made from this graph?

A. Temperature is unrelated to the reproductive rate of bacteria.
B. Bacteria cannot grow at a temperature of 5°C.
C. Life activities in bacteria slow down at high temperatures.
D. Refrigeration will most likely slow the growth of these bacteria.

18. A study was completed using two groups of 10 plants of the same species. During the study, the plants were placed in identical environmental conditions. The plants in one group were given a growth solution every 3 days. The heights of the plants in both groups were recorded at the beginning of the study and at the end of a 3-week period. The data showed that the plants given the growth solution grew faster than those not given the solution. When other researchers conduct this study to test the accuracy of the results, they should

    A. give growth solution to both groups
    B. make sure the conditions are identical to those in the first study
    C. give an increased amount of light to both groups of plants
    D. double the amount of growth solution given to the first group

19.

A study was made to determine the effect of different salt concentrations on the number of contractions per minute of contractile vacuoles of paramecia. Four beakers of water containing different salt concentrations and equal numbers of paramecia were prepared. All other environmental conditions were kept constant. The paramecia were then observed with a compound microscope, and the contractions of the vacuoles were counted and recorded in the table below.

Data Table

Beaker	Salt Concentration (mg/mL)	Contractions per Minute
A	0.000	5.5
B	0.001	4.0
C	0.010	2.5
D	0.100	1.5

Base your answer on the information and data table in the graphic. According to the information in the data table, which statement is true?

    A. Beaker *B* has a lower salt concentration than beaker *A*.
    B. Beaker *C* has a lower salt concentration than beaker *D*.
    C. The paramecia in beaker *A* respond the least to the water concentration in the beaker.
    D. The paramecia in beaker *D* have nonfunctioning contractile vacuoles.

20.

Data Table

Temperature (°C)	Microorganism Growth (Number of Colonies)	
	Strain A	Strain B
25	10	11
28	10	7
31	11	3
34	12	0

A student performed an experiment involving two strains of microorganisms, strain A and strain B, cultured at various temperatures for 24 hours. The results of this experiment are shown in the data table. Based on the results of the experiment, the student inferred that strain A was more resistant to higher temperatures than strain B was. What, if anything, must the student do for this inference to be considered valid?

    A. nothing, because this inference is a valid scientific fact
    B. repeat this experiment several times and obtain similar results
    C. repeat this experiment several times using different variables
    D. develop a new hypothesis and test it

Answer Key 1: Scientific Method

1. C
2. D
3. C
4. D
5. C
6. D
7. A
8. B
9. A
10. D
11. C
12. D
13. B
14. B
15. C
16. A
17. D
18. B
19. B
20. B