

# Longitudinal Study of American Youth

## SCIENCE

### Form (C)

#### INTRODUCTION

This booklet contains questions about science for you to answer. You will be able to answer some of the questions quickly and others will require more thought. Please do not feel discouraged if you are not absolutely sure of an answer. Some questions will ask about things you have covered in class, but others will not. Please do your best to answer each question. If you are not sure of the answer, read the question again, and make your best guess.

#### MARKING YOUR ANSWERS

Each question is followed by a set of possible answers labeled A, B, C, etc. Read each question carefully, then choose the *one* answer you think is the best, and darken in the letter on your *Answer Sheet* next to the number for that question. Be sure to mark only *one* letter for each question. Do not skip any questions.

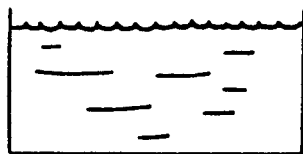
Do not make any stray marks on your *Answer Sheet*. Do all of your calculations on the Question Booklet, and use the *Answer Sheet* only to record your answers.

If you have any questions while taking this test, raise your hand, and the person giving the test will come to your seat to help you.

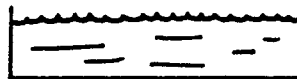
## Social Science Research Institute

Northern Illinois University DeKalb, Illinois 60115

- Questions 1-3. Two flames of the same size were used to heat the two pans of water shown below. Both pans were heated until they reached 90 degrees Celsius.



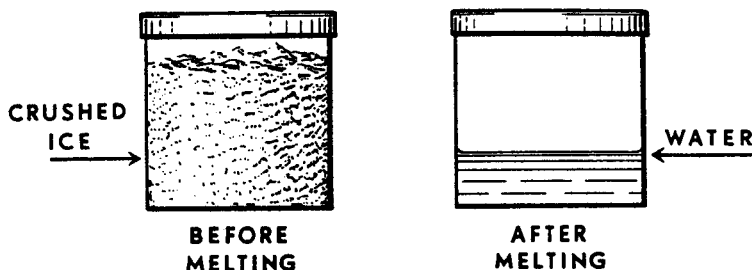
Pan 1



Pan 2

- In which pan did the temperature reach 90 degrees first?  
 (A) Pan 1 (B) Pan 2 (C) Both at the same time N404901
- To which pan was the most heat added?  
 (A) Pan 1 (B) Pan 2 (C) Same amount was added to both N404902
- Which pan cooled down the fastest when the flame was turned off?  
 (A) Pan 1 (B) Pan 2 (C) Both at the same time N404903

The can below was filled with crushed ice, sealed, and weighed. The ice was melted by slowly warming the can and its contents. No water vapor escaped and no air entered the can.

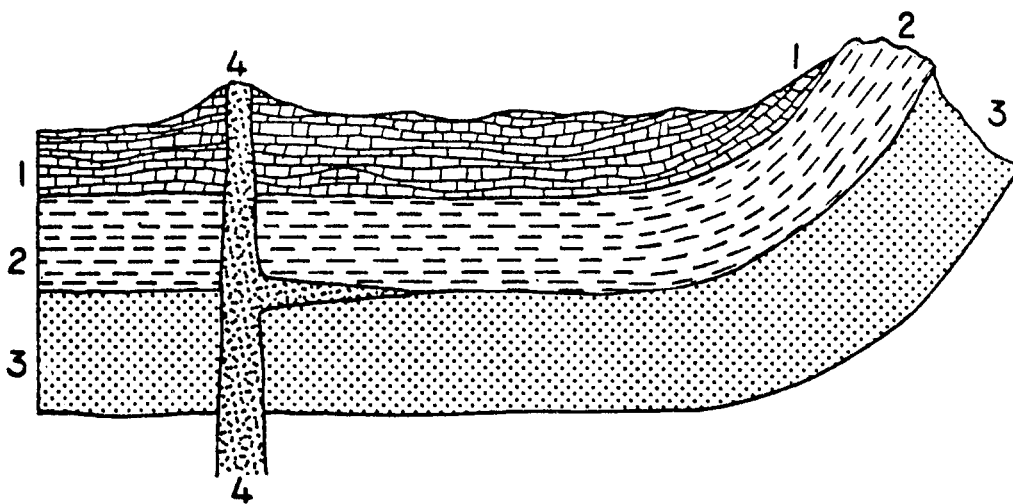


- The can was then weighed again. Which one of the following results would you expect to find?  
 (A) The weight was the same. (C) The weight was less. N405101  
 (B) The weight was more.
- When phosphorus,  $P_4$ , is exposed to air, it reacts with oxygen,  $O_2$ , to form an oxide,  $P_4O_{10}$ . Which one of the following represents the balanced equation for the reaction?  
 (A)  $P_4 + O_2 \rightarrow P_4O_{10}$  (C)  $4 P_4 + 5 O_2 \rightarrow P_4O_{10}$   
 (B)  $P_4 + 10 O_2 \rightarrow P_4O_{10}$  (D)  $P_4 + 5 O_2 \rightarrow P_4O_{10}$  N411801
- Elements with chemical characteristics most similar to those of sodium are listed in what part of the periodic table?  
 (A) Immediately to the right of sodium in the same row  
 (B) Immediately to the left of sodium in the same row  
 (C) Above and below sodium in the same column  
 (D) On the far right of the periodic table N419601

7. What happens to the sulfur dioxide released by a factory's smokestacks?
- (A) The sulfur dioxide stays in the air forever.
  - (B) The sulfur dioxide immediately falls to earth as dust.
  - (C) The sulfur dioxide eventually falls to earth as acid rain.
  - (D) The sulfur dioxide escapes from the atmosphere into space.

N405501

- Questions 8-9. This diagram represents a cross-section of one part of the earth's crust. Layers 1, 2, 3 and 4 are each different kinds of rock.



8. Which layer is oldest?

(A) 1  
(B) 2

(C) 3  
(D) 4

N407301

9. How can the curve of Layer 2 be explained?

- (A) Layer 2 is sedimentary rock which was formed by sediment collecting on an underwater hillside.
- (B) Layer 2 was probably flat once, but it has been bent by huge earth forces.
- (C) There must be something wrong with the diagram because all rock layers are flat and level.

N407302

10. The shape of the Earth's shadow during an eclipse of the Moon indicates that the shape of the Earth could be like which of the following?

(A) A cylinder  
(B) A doughnut

(C) A pyramid  
(D) A cube

N429201

11. Karen has found a gray rock. Which of the following would be of LEAST help to her in determining whether it is a limestone (carbonate) rock?

(A) Finding fossils in the rock  
(B) Checking the hardness of the rock

(C) Placing some acid on the rock  
(D) Measuring the volume of the rock

N420301

12. Iceland and Southern Greenland are about the same distance from the equator. Many more people live in Iceland where the climate is warmer. What is the best reason for the warmer climate in Iceland?
- (A) Southern Greenland is more mountainous than Iceland.
  - (B) Iceland receives more sunlight than Southern Greenland.
  - (C) Ocean currents bring warmer water to the coast of Iceland.
  - (D) Iceland has more hot springs than Southern Greenland.
- N410201

13. What is the probability that two people who are hybrid for brown eyes ( $Bb$ ) will have a blue-eyed child? ( $B$  = genes for brown eye color;  $b$  = genes for blue eye color)
- (A) 0%
  - (B) 25%
  - (C) 50%
  - (D) 75%
- N432601

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► Questions 14-15. As an experiment, Mary grew some plants in the refrigerator and some plants on the window sill. She watered the ones on the window sill every day. For two days she forgot to water the ones in the refrigerator. The plants on the window sill grew 4 centimeters. The plants in the refrigerator grew 2 centimeters.

14. What could be correctly concluded on the basis of this experiment?
- (A) The plants on the window sill grew taller because they got more light.
  - (B) The plants on the window sill grew taller because they got more water.
  - (C) There is no way to be sure why the plants on the window sill grew taller.
- N411501
15. Why couldn't Mary say the plants on the window sill grew taller just because they were in a warmer place?
- (A) Because the plants on the window sill got more water than those in the refrigerator
  - (B) Because she used the same kinds of plants in each place
  - (C) Because she used the same sized pots
- N411502

16. It is often said that more people of the world could be fed with available food if people ate more organisms on the lower end of a food chain. What is the biological basis for this claim?
- (A) Certain organisms are more nutritious than others.
  - (B) The Earth contains less biomass at lower levels.
  - (C) Agricultural pests and bacteria would have less opportunity to destroy food.
  - (D) There is a loss of potential energy at each transfer from the producers to higher-order consumers of a food chain.

N426801

17. A medical researcher wanted to find out what caused a certain disease. She gathered the following information from different places in the world.

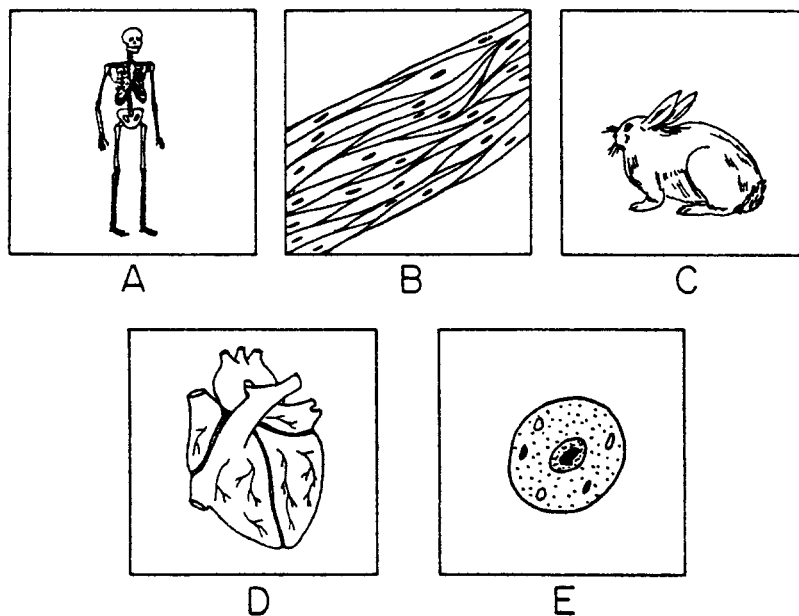
	Major Type of Food	Type of Area	Mosquitoes	Disease
Country 1	Fish only	City	Yes	Yes
Country 2	Meat and vegetables	Farmland	No	No
Country 3	Fish and rice	City	No	Yes
Country 4	Fish only	Farmland	Yes	Yes

Which one of the following would be best for the researcher to study more closely in order to find the cause of the disease?

- (A) Major type of food
- (B) Type of area
- (C) Mosquitoes
- (D) Swamps

N411201

Look at the pictures below, then answer the question.



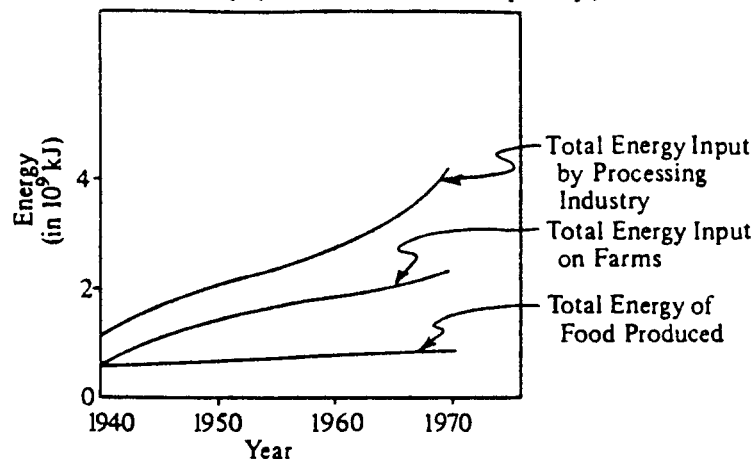
18. Which one of the following best shows the order of these pictures from *simplest* to *most complex*?
- (A) A B C D E
  - (B) E B D A C
  - (C) E A D B C
  - (D) C A B D E
  - (E) A C E D B

N405801

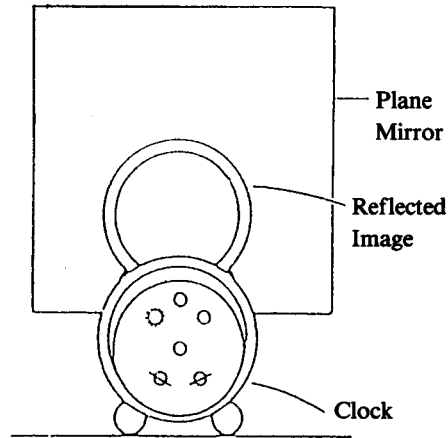
19. Why are environmental-protection groups often opposed to the burning of coal to produce electricity?
- (A) Power plants using coal require a great deal of space.
  - (B) Coal is in limited supply.
  - (C) The burning of coal releases pollutants into the air.
  - (D) Coal is more expensive to burn than wood.
- N435201
20. Methods that are recommended for the control of soil erosion include all of the following EXCEPT
- (A) plowing leftover plant stubble to clear the land.
  - (B) using strip-cropping on cultivated land.
  - (C) making terraces on cultivated slopes.
  - (D) taking out of cultivation all areas with very steep slopes and planting grass or trees as cover.
- N426601
21. A female white rabbit and a male black rabbit mate and have a large number of baby rabbits. About half of the baby rabbits are black, and the other half are white. If black fur is the dominant color in rabbits, how can the appearance of white baby rabbits best be explained?
- (A) The female rabbit has one gene for black fur and one gene for white fur.
  - (B) The male rabbit has one gene for black fur and one gene for white fur.
  - (C) The white baby rabbits received no genes for fur color from the father.
  - (D) The white baby rabbits are result of accidental mutations.
- N424401

**ENERGY USE IN FOOD SYSTEM *VERSUS*  
ENERGY OF FOOD PRODUCED**

(Energy of food produced is  
population times 11.30 kJ per day.)

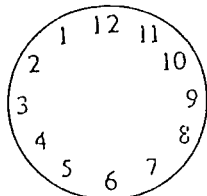


22. According to the graph above, when and where did the largest increase in the amount of energy used for the production of food occur?
- (A) In the processing industry between 1940 and 1950
  - (B) In the processing industry between 1960 and 1970
  - (C) On the farms between 1940 and 1950
  - (D) On the farms between 1960 and 1970
- N436001

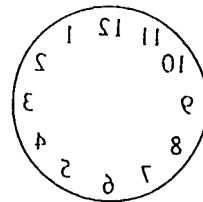


23. A clock is placed in front of an ordinary mirror, as shown above. How would the numbers on the face of the clock appear in the mirror?

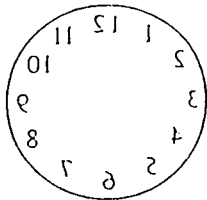
(A)



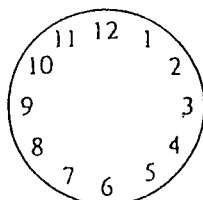
(C)



(B)



(D)



N412701

24. Which of the following best explains why logs can be floated down a river?

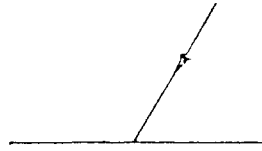
- (A) Wood has a lower mean density than water and so will remain only partly submerged in the water.
- (B) The buoyant force of the water on the logs is less than the weight of the logs.
- (C) River water has a greater density than pure water because river water contains many dissolved minerals.
- (D) Logs are not porous and so they cannot absorb any water.

N422301

25. Which of the following is the best way to induce an electrical current in a coil of wire?

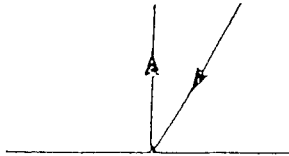
- (A) Heating the coil uniformly
- (B) Surrounding the coil with oil
- (C) Pounding the coil with a hammer
- (D) Rotating the coil in a magnetic field
- (E) Stroking the coil with a piece of cat's fur

N407901

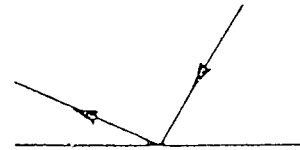


26. A ray of light shines on a mirror at the angle shown above. Which diagram shows what will happen to the light after it strikes the mirror.

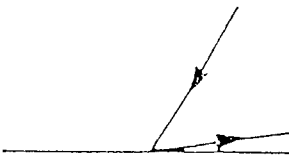
(A)



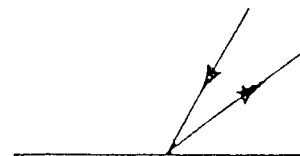
(D)



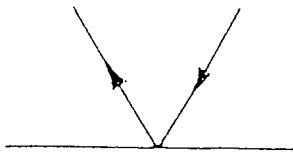
(B)



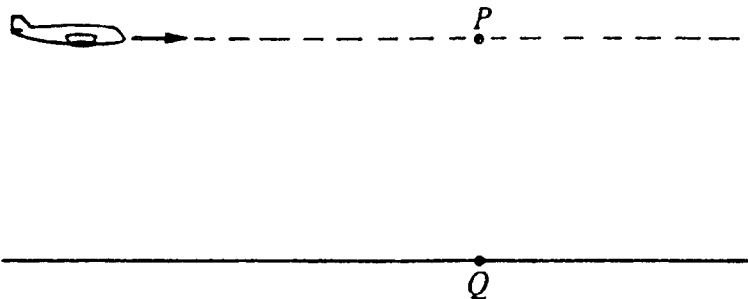
(E)



(C)



N407201



27. An airplane flies in a straight level line at constant speed as shown above. A package is to be dropped from the plane so that it hits a target at point  $Q$ . Point  $P$  is directly over the target. When should the package be dropped?

- (A) At a certain time before the plane reaches point  $P$
- (B) At the instant that the plane reaches point  $P$
- (C) Immediately after the plane passes point  $P$
- (D) Several seconds after the plane has passed point  $P$

N422201

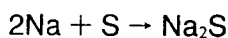


28. Light travels at a speed of approximately 186,000 mi/sec and sound travels at a speed of approximately 0.2 mi/sec. A flash of lightning is seen and the resulting thunder is heard 10 seconds later.

How far away from the observer did the lightning occur?

- (A) 0.02 mile
- (B) 1 mile
- (C) 2 miles
- (D) 10 miles
- (E) 20 miles
- (F) 186,000 miles

N407101



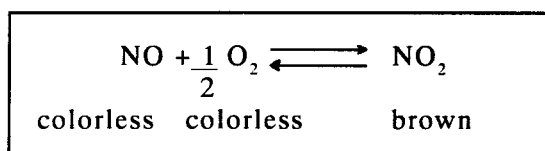
29. The mass of 1.0 mole of sodium, Na, is 23.0 grams. The mass of 1.0 mole of sulfur is 32.1 grams. Approximately what mass of sodium is required to react completely with 32.1 grams of sulfur in the reaction above?

- (A) 11.5 grams
- (B) 23.0 grams
- (C) 32.0 grams
- (D) 46.0 grams

N433901

30. Nitric oxide (NO) is a colorless gas.  
Oxygen (O<sub>2</sub>) is a colorless gas.  
Nitrogen dioxide (NO<sub>2</sub>) is a brown gas.

If one volume of nitric oxide (NO) is injected into a closed container holding ½ volume of oxygen, the reaction shown in the box occurs:



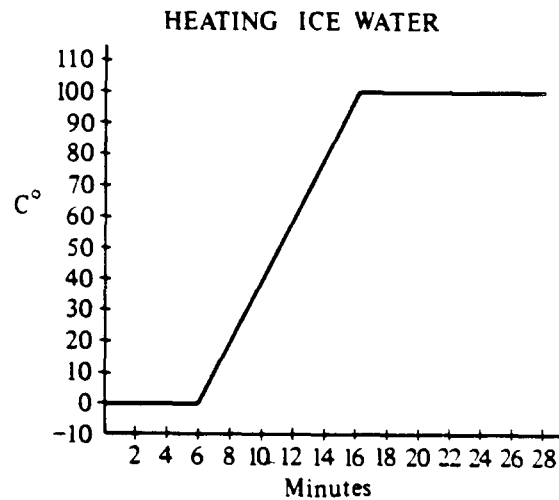
At 250°C the brown color reaches a constant value very rapidly. However, analysis of the gases in the container shows that there are significant amounts of colorless nitric oxide (NO) and colorless oxygen (O<sub>2</sub>) along with the brown nitrogen dioxide (NO<sub>2</sub>).

All three gases are present because

- (A) an error was made either in amounts added or the final analysis.
- (B) oxygen is a catalyst for the reaction and a catalyst is not used up.
- (C) the nitric oxide and oxygen molecules remaining have stopped reacting with each other.
- (D) brown nitrogen dioxide is decomposing to the original materials as fast as it forms from them.

N412001

- Questions 31-32. A beaker containing crushed ice and water is heated. The temperature of the beaker's contents is recorded every 30 seconds. A graph of the data appears below.



31. Approximately when does active boiling of the contents of the beaker occur?
- (A) From the beginning of the process  
 (B) Between 2 and 6 minutes after the heating begins  
 (C) Between 6 and 16 minutes after the heating begins  
 (D) After approximately 16 minutes of heating
- N418701
32. In the graph the temperature remains constant from 0 to 6 minutes and again after 16 minutes. During these two time periods, the heat energy was used to do which of the following?
- (A) To heat the sides of the beaker  
 (B) To remove air molecules from the water  
 (C) To expand the distance between the molecules of water  
 (D) To change the state of matter in the beaker
- N418702

33. An ore sample contains 50 grams of radioisotope with a half-life of 5 seconds. After 10 seconds, how many grams of the radioisotope are in the sample?
- (A) 12.5 grams  
 (B) 25 grams  
 (C) 50 grams  
 (D) 75 grams

34. At sea level, H<sub>2</sub>O is a solid at temperatures below 0°C, a liquid between 0°C-100°C, and a gas at temperatures above 100°C. When water vapor is cooled to liquid water, energy is released. Based on these data, which of the following is the best conclusion that can be drawn?

- (A) Matter has three physical states.
- (B) Solids can only exist at temperatures below 0°C.
- (C) Water at 10°C has the same amount of energy as water at 90°C.
- (D) A given mass of water has more energy as a gas than as a solid.

N437501

35. The ores of many metals are sulfides of the metals. In the refining process these ores are “roasted,” that is, the sulfur is combined with oxygen, liberating the metal or its oxide (e.g.,  $\text{CuS} + \text{O}_2 \rightarrow \text{Cu} + \text{SO}_2$ ). This process is most likely to result in which of the following?

- (A) Acid rain
- (B) Aging of lakes
- (C) Depletion of the ozone layer
- (D) Lead poisoning

N429701

36. A paper manufacturing company in your area produces large amounts of sulfuric acid as a waste by-product. In spite of efforts to carefully dispose of the waste, some of the acid continually escapes recovery and pollutes a nearby river, affecting wildlife and recreation. The company employs many area residents. Which of the following solutions to help stop the pollution would be preferred by the community?

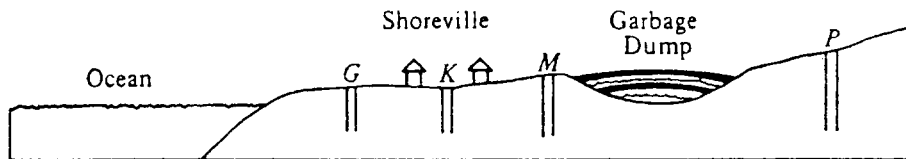
- (A) Moving the company to a more isolated area and giving the workers the option to move
- (B) Adding a substance to the escaping acid to neutralize it
- (C) Adding an acid with a higher pH to the escaping acid
- (D) Storing the escaping acid in large holding tanks and then taking it to an industrial waste landfill

N429601

37. Concern has been expressed about the greenhouse effect of carbon dioxide, CO<sub>2</sub>, on the Earth’s atmosphere. The CO<sub>2</sub> allows sunlight to penetrate to the surface but blocks long-wave infrared radiation from escaping to space. If we continue to burn fuels at an increasing rate, all of the following are likely to occur EXCEPT:

- (A) Atmospheric CO<sub>2</sub> will increase.
- (B) Less heat will be trapped in the atmosphere.
- (C) Sea levels will rise.
- (D) The antarctic ice sheet will become smaller.

N437101



38. The city of Shoreville is considering drilling a well as a source of drinking water at locations *G*, *K*, *M*, or *P*, shown above. Which of the well sites would be the best choice for the benefit of the community?

- (A) Location *P*, because there is less chance of contamination and therefore it would be safer.
- (B) Location *K*, because it is closer to Shoreville and therefore waterlines would be cheaper to construct.
- (C) Location *G*, because there would be more water and it would serve more people.
- (D) Location *M*, because buying the land would be easier and less expensive.

N417901

39. An artificial satellite travels in an easterly direction and orbits the Earth every 6 hours. To an observer in the central United States, the satellite would appear to

- (A) rise in the east and set in the west.
- (B) rise in the west and set in the east.
- (C) remain stationary above the observer's position.

N434801

40. Which statement best describes how the earth's rocks change over billions of years?

- (A) Large rocks break up into smaller and smaller pieces, until most of the whole surface is sand.
- (B) Grains of sand form together into larger and larger pieces until most of the surface is solid rock.
- (C) Large rocks break up and are eventually formed back into rocks, and so on over and over again.
- (D) Large rocks and sand stay side by side with very little change.

N407801

41. The burning of fossil fuels has increased the carbon dioxide content of the atmosphere. What is the most immediate effect that this increasing amount of carbon dioxide is likely to have on our planet?

- |                      |                                 |
|----------------------|---------------------------------|
| (A) A warmer climate | (C) Decreased relative humidity |
| (B) A cooler climate | (D) Increased relative humidity |

N428401

42. The atomic age has produced tools that have been particularly useful in understanding the biological process of photosynthesis. Which of the following are of most use to researchers in studying this process?

- |                          |                    |
|--------------------------|--------------------|
| (A) Radioactive isotopes | (C) X-ray machines |
| (B) CAT scanners         | (D) Laser beams    |

N427901

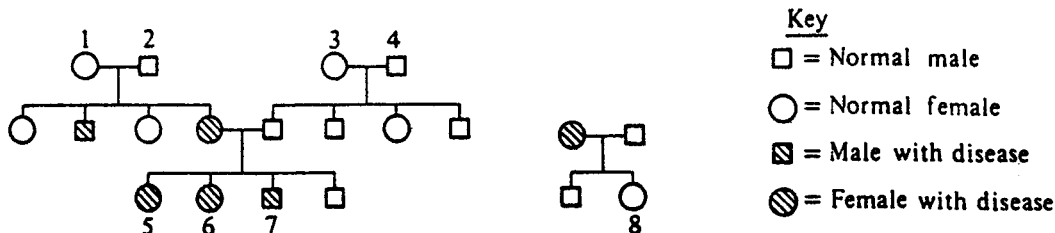
Tube Number	Tube Contents	Iodine Test	Benedict's Test	Biuret Test
1	Sugar	Brown	Green, Orange	Blue
2	Starch	Blue-Black	Blue	Blue
3	Protein	Brown	Blue	Purple
4	Egg White	Brown	Blue	Purple
5	Water	Brown	Blue	Blue

43. Based on the results of the investigation shown above, egg white contains which of the following?

- (A) Sugar only
- (B) Starch only
- (C) Protein only
- (D) Sugar, starch, and protein

N426901

► Questions 44-45. The pedigree chart below shows the occurrence of a hypothetical inherited disease.



44. The disease is probably inherited by a mechanism involving which two of the following types of genes?

- (A) Recessive and sex-linked
- (B) Dominant and sex-linked
- (C) Recessive and not sex-linked
- (D) Dominant and not sex-linked

N430001

45. If one uses the letter A to represent the dominant trait and the letter a to represent the recessive trait, what is the genotype of Individual 2 for this trait?

- (A) AA
- (B) Aa
- (C) aa

N430002

46. The density of granite is approximately 2.7 grams per cubic centimeter. What would be the approximate mass of a cube of granite 10.0 centimeters on a side?

- (A) 10 grams
- (B) 27 grams
- (C) 270 grams
- (D) 2,700 grams

N432201

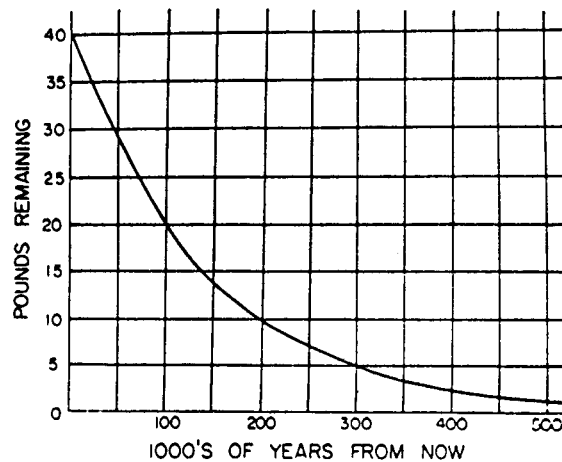
47. A student wanted to study the effect of heat on the growth of a particular type of plant. She placed one seedling in each of ten identical pots that contained the same type of soil, and she gave each pot the same amount of water. She then divided the pots into two groups. She placed one group on a window sill where it would be heated by the Sun and placed the other group in a closet on the cool (north) side of her house.

What was wrong with the design of her experiment?

- (A) The temperature difference between the two sets of seeds was not great enough to make a difference.
- (B) Seedlings require light to grow.
- (C) Both heat and light were different for the two groups.
- (D) One group of seedlings was cooler than the other.

N425801

48.



A radioactive substance decays into another element. The curve in the graph above shows how much of the radioactive substance remains over time. From the graph, estimate the *half-life* of the substance.

- (A) 50,000 years
- (B) 100,000 years
- (C) 250,000 years
- (D) 500,000 years
- (E) 1,000,000 years

N411901

49. If the temperature drops during the night, the air pressure in an automobile tire

- (A) increases.
- (B) decreases.
- (C) increases or decreases, depending on the humidity.
- (D) stays the same.

N410701

50. A student measured the mass of a solid on an analytical balance, and then measured its volume by water displacement in a graduated cylinder whose smallest calibration was 1 milliliter. He correctly reported these measurements as follows.

$$\begin{aligned}\text{Mass} &= 7.7250 \text{ grams} \\ \text{Volume} &= 5.5 \text{ ml}\end{aligned}$$

How should the student report the density of the substance?

- (A) 1.4 g/ml
- (B) 1.40 g/ml
- (C) 1.405 g/ml
- (D) 1.4045 g/ml

N432001

51. A weather report will often have statements like "There is a 20% chance of rain tomorrow." What is meant by this forecast?

- (A) In the past, when conditions were similar, it rained the next day about 20% of the time.
- (B) It will rain 20% of the time during the day.
- (C) If it rains tomorrow, we are likely to have about 20/100 inches of rain.
- (D) Weathermen are right about 20% of the time in making such forecasts.
- (E) It will rain over 20% of a given region; for example, a city or a county.

N409501

52. Which of the following objects has the greatest density?

Mass of Object	Volume of Object
(A) 11.0 grams	24 cubic centimeters
(B) 11.0 grams	12 cubic centimeters
(C) 5.5 grams	4 cubic centimeters
(D) 5.5 grams	11 cubic centimeters

N426201

53. Boston is a city at sea level and Denver is over 5,000 feet above sea level. Which of the following is true when 1 liter of pure water is heated to boiling in Denver?

- (A) The boiling point is lower than in Boston.
- (B) The boiling point is higher than in Boston.
- (C) It takes longer to heat the water to boiling than in Boston.
- (D) It takes more energy to heat the water to boiling than in Boston.

N437301

### **ABOUT THIS TEST**

Please answer the following questions after you have completed this test. Record your answers in the box at the end of the answer sheet.

- A. How much of the material covered on this test has been taught in your classes?
- B. How difficult was this test for you?
- C. How well do you think you did on this test?
- D. How hard did you work to do well on this test?

### **WHEN YOU HAVE FINISHED**

Please check to make sure you have marked *one* answer for each question. When you have checked your answers, place your *Answer Sheet* inside the front cover of the test booklet. All of the booklets will be collected at the same time after everyone is finished. Please sit quietly while others are completing their work.



