

Middles Grades Science Practice Questions



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Practice Test

Practice Questions

1. Which of the following compounds is not allowed in a school laboratory because it is a potential carcinogen?
 - a. Lead
 - b. Benzene
 - c. Aspartame
 - d. Methanol
2. A laboratory experiment requires that red blood cells be separated from the serum in whole blood. Which of the following laboratory techniques would be most appropriate for this task?
 - a. Spectroscopy
 - b. Sublimation
 - c. Microscopy
 - d. Centrifugation
3. Which of the following quantities is largest in the metric system of measurement?
 - a. 10 decigrams
 - b. 100 milligrams
 - c. 100 grams
 - d. 1 decagram
4. In an experiment on respiration, carbon dioxide production is measured over time. Placing the data in a chart is
 - a. A visual representation of the data
 - b. A conclusion based on the data
 - c. The raw data
 - d. A comparative analysis of the data
5. In order to be included in the formation of a scientific conclusion, evidence must be
 - a. Quantitative
 - b. Reproducible
 - c. Obvious
 - d. All of the above
6. A researcher is studying the response of bacteria to a certain chemical. In three experiments, the bacteria swim towards the chemical, and in one experiment the bacteria swim away from it. What would be the most appropriate next step for the researcher?
 - a. Report only the first three experiments.
 - b. Report all the experiments, but refrain from making any conclusions.
 - c. Repeat the experiment several more times and apply a statistical analysis to the data.
 - d. Repeat the experiment, adding a new chemical to determine its effect on the bacteria.

7. Which of the following biological discoveries was made first?
- Louis Pasteur discovered the causative role of microorganisms in disease.
 - Charles Darwin discovered the principles of natural selection.
 - Gregor Mendel discovered that genes are the basic units of inheritance.
 - Carl Von Linnaeus discovered that living things could be organized into a binomial system of nomenclature.
8. In a study investigating the causes of stomach ulcers, researchers observed that coffee drinkers had a higher incidence of stomach ulcers than those who didn't drink coffee. This is an example of
- A controlled experiment
 - A cause and effect relationship
 - Correlation between two variables
 - Systematic error in sampling
9. Which of the following is an example of a renewable resource?
- Trees
 - Ore minerals
 - Fossil fuels
 - Cash crops
10. Which of the following is NOT a significant factor in the dramatic increase of the human population over the past few hundred years?
- Increased availability of habitable land
 - Scientific advances in agriculture
 - Improved sanitation
 - An understanding of the causes of communicable diseases
11. Which of the following is a constant?
- The freezing point of water
 - The temperature at which iron ore will melt
 - The human population size
 - The time the sun rises each day
12. Which of the following is an example of a chemical reaction?
- Heating ethanol so that it evaporates
 - Igniting ethanol so that it burns
 - Dissolving salt in water
 - Making ice cubes in a freezer
13. Of the following, which is the most basic unit of matter?
- A helium atom
 - A sodium ion
 - A proton
 - An oxygen molecule

14. Which of the following phenomena would most readily lend itself to mathematical modeling?
- The position of an electron in orbit around the nucleus of an atom
 - The rate of blood flow through an artery
 - The force required to extend a metal spring by a certain length
 - The rate at which cells divide in an embryo
15. Without _____ applied to it, an object in motion will tend to stay in motion.
- Force
 - Inertia
 - Gravity
 - Acceleration
16. A car trip to a point 50 miles away from home and back takes four hours. The top speed of the car was 50 miles per hour, and this speed was maintained during the second and third hours of the trip. Which of the following values represents the average velocity of the car?
- 0 miles/hour
 - 12.5 miles/hour
 - 25 miles/hour
 - 50 miles/hour
17. Which of the following properties of a meteorite moving through the planet's atmosphere would change as it approached the surface of the earth?
- Its mass
 - Its volume
 - Its density
 - Its weight
18. Which of the following is NOT an example of one of Newton's laws of motion at work?
- Once in orbit, a satellite will continue moving around the earth.
 - It takes three times as much force to move a block that has twice the mass of another.
 - A ball rolling across the floor will continue moving across the floor.
 - When a shotgun is fired, the gun moves sharply in the opposite direction of the bullet.
19. Heating a liquid will most likely change its
- Crystal structure
 - Density
 - Mass
 - Electrical conductivity
20. Which of the following changes in physical properties is a chemical change?
- Dissolving a seltzer tablet in water
 - Grinding pepper into powder
 - Freezing water
 - Churning cream into butter

21. Which of the following is a property of nonmetals?
- They are good conductors of electricity.
 - They do not form isotopes.
 - They react with metals.
 - They are dense, hard, and have high melting points.
22. An element on the periodic table will have chemical reactivity most like the element
- To the right or left of it on the table
 - Above or below it on the table
 - Within two horizontal spaces of it on the table
 - Placement on the table is not related to the chemical properties of an element.
23. Which of the following components of an atom varies in isotopes?
- Protons
 - Neutrons
 - Electrons
 - Leptons
24. Which of the following components of an atom is most likely to be lost or gained in a chemical reaction?
- Protons
 - Neutrons
 - Electrons
 - Isotopes
25. Which of the following substances is most likely to contain acetic acid?
- Cream of tartar
 - Vinegar
 - Baking powder
 - Water
26. In photosynthesis, what kind of chemical reaction transforms CO_2 into carbohydrates?
- Oxidation
 - Chemiosmosis
 - Reduction
 - Hydrolysis
27. Which of the following does NOT contribute to an object's potential energy?
- Mass
 - Gravity
 - Height
 - Temperature
28. Energy is measured in
- Joules
 - Volts
 - Ohms
 - Amperes

29. The human eye perceives leaves on a tree as green because of light that is
- Absorbed
 - Refracted
 - Reflected
 - Diffacted
30. Which of the following kinds of waves require particles to propagate?
- Radio waves
 - Sound waves
 - Microwaves
 - X-rays
31. The primary chemical process in the sun that creates light is
- The fission of helium into hydrogen
 - The fission of lithium into helium and hydrogen
 - The fusion of hydrogen into helium
 - The fusion of helium into beryllium
32. The British Isles on the east side of the Atlantic Ocean are often warmer than the coastal parts of Canada at the same latitude. This is because ocean currents warm the atmosphere of the British Isles. This kind of heat transfer is called
- Radiation
 - Convection
 - Thermoregulation
 - Transduction
33. In an experiment, you want to measure the amount of mass a piece of wood liberates when it burns. The most accurate way of doing this would be to
- Measure the volume and pressure of the gases emitted by the burning wood, and then calculate the number of molecules present.
 - Chill the gases emitted by the burning wood over liquid nitrogen so the mass of the solid carbon dioxide (dry ice) can be measured.
 - Determine the mass of the ash after the wood burns.
 - Measure the mass of the wood before and after it burns.
34. If a refrigerator was running in an empty room with its door open, the temperature of the room would eventually
- Increase
 - Decrease
 - Stay the same
 - It depends on the size of the room.
35. All of the following are membrane-bound organelles except
- Nucleoli
 - Chromoplasts
 - Mitochondria
 - Endoplasmic reticulum

36. All living things have
- Organelles
 - Cells
 - Tissues
 - Cell walls
37. On the ocean floor, volcanoes can erupt, causing what are known as thermal vents. Temperatures can be very high near these vents. Which of the following types of organisms would most likely live near them?
- Protists
 - Eukaryotes
 - Prokaryotes
 - Metazoans
38. Which class of hormones is most likely to be released after a serious injury?
- Acetylcholine
 - Oxytocin
 - Luteinizing hormone
 - Endorphins
39. The component of blood essential for clotting is the
- Plasma
 - Platelets
 - Erythrocytes
 - Leukocytes
40. Which of the following biomolecules is NOT a polymer?
- Cellulose
 - DNA
 - Phospholipid
 - Protein
41. Which of the following organisms is capable of undergoing asexual reproduction?
- Ferns
 - Yeast
 - Flowering plants
 - Trees
42. A purple-flowered pea plant is crossed with a white-flowered pea plant and all of the progeny are purple. The purple allele is _____ to white.
- Recessive
 - Dominant
 - Codominant
 - Not enough information is given to tell.

43. A color-blind woman marries a man with normal vision. What proportion of their daughters will be color blind if color blindness is a recessive sex-linked trait?
- 100%
 - 50%
 - 33%
 - 0%
44. In order to clone a gene, what must a researcher have or know?
- Its cDNA
 - Its expression profile
 - Its method of transcription
 - Its phenotype
45. The horn of a rhinoceros and human hair are evolutionarily related. They are
- Ancestral characteristics
 - Detrimental characteristics
 - Homologous characteristics
 - Analogous characteristics
46. In highly industrialized areas, trees used to become covered in soot. Eventually, most moths found in that area were gray rather than white. Which factor most likely contributed to the change in color of these moths?
- Natural selection
 - Genetic drift
 - Sexual selection
 - Punctuated equilibrium
47. Which of the following is the most likely explanation for the reason finches on separate islands within an archipelago have differently shaped beaks?
- Each bird evolved from a pre-existing ancestor on each island.
 - The finches spread among the islands, but in small numbers, so genetic drift caused beak shape to change.
 - Natural selection shaped the beaks in accordance with food availability on each island.
 - The different finches were introduced by ancient humans.
48. Which of the following is NOT a useful source of evidence with respect to the evolutionary history of an organism?
- Its placement in the fossil record
 - Its anatomy
 - Its distribution among the continents
 - Its population size
49. When a mimosa plant is touched on its leaves, they rapidly crumple, and then gradually relax again after the stimulus stops. This is an example of a(n)
- Innate behavior
 - Learned behavior
 - Response to stimuli
 - Single cell response

50. Which organ system is most responsible for maintaining control of body temperature?
- The skeletal system
 - The circulatory system
 - The immune system
 - The muscular system
51. When animals eat, insulin is released from the pancreas, stimulating glucose uptake by the liver. When glucose levels drop, the pancreas reduces insulin release. This is an example of which mechanism for maintaining homeostasis?
- Negative feedback
 - Positive feedback
 - Stress response
 - Parasympathetic regulation
52. Orchids grow on the trunks or branches of trees. They receive more light than they would on the forest floor and absorb nutrients that run down tree trunks or along branches. This ecological relationship is best described as
- Mutualism
 - Competition
 - Parasitism
 - Commensalism
53. An ecosystem consists of
- The abiotic environment
 - A collection of populations
 - A community of organisms and the physical environment
 - Many populations of a species interacting with one another
54. A biome contains
- Populations that are independent of each other
 - Species with shared evolutionary histories
 - At least one biosphere
 - Independently evolving species
55. The size of a population is constrained by
- The carrying capacity of its habitat
 - The size of the organism
 - The neighboring communities
 - The biome in which it is located
56. A mouse that feeds on grain is a part of which trophic level?
- Primary producer
 - Primary consumer
 - Secondary consumer
 - Decomposer

57. In an ear infection, bacteria become trapped in the middle ear and colonize it. The bacteria in the infection would be considered
- A population
 - A community
 - An ecosystem
 - Individuals
58. Which of the following is a true statement about a caldera?
- It is formed when a massive explosion destroys the cone of a volcano.
 - It is created when the rock above a fault plane moves up relative to the rock below.
 - It is a class of volcano characterized by quiet eruptions.
 - It is formed by cooling lava.
59. Which of the following does NOT contribute to the creation of ocean currents?
- Wind
 - The moon's gravitational pull
 - Ice cap and glacial melting
 - The sun's heat
60. The percentage of the earth's water that is saline most closely matches which figure?
- 98%
 - 70%
 - 30%
 - 2%
61. Which type of rock is formed by high temperatures and great pressures?
- Sedimentary rock
 - Igneous rock
 - Composite rock
 - Metamorphic rock
62. Which of the following is NOT part of the carbon cycle?
- Respiration
 - Sedimentation
 - Transpiration
 - Decomposition
63. Nitrogen becomes available to organisms solely as a result of
- Photosynthesis
 - Leaching from rocks
 - Decomposition
 - Nitrogen-fixing bacteria
64. The factor most responsible for determining which season an area is experiencing is
- Elevation
 - The position of the earth in its orbit around the sun
 - Latitude
 - Air masses

65. The point at which water vapor in the air begins to condense is called the
- Relative humidity
 - Barometric pressure
 - Dew point
 - Gulf stream
66. What is the main type of chemical reaction in the sun?
- Nuclear fusion
 - Nuclear fission
 - Nucleation
 - Hydrogenation
67. When a star burns itself out, it can collapse to such a degree that light becomes trapped by its intense gravitational field. Such an instance creates
- A quasar
 - A pulsar
 - Dark matter
 - A black hole
68. Which of the following is the best definition of a comet?
- A mass of gases that produces massive amounts of energy through nuclear fusion
 - A mass of frozen gases, cosmic dust, and rocky particles
 - Particles of rock that pass through the earth's atmosphere
 - A massive satellite that orbits a planet
69. Given the half-life of the following radioactive isotopes, which would be most useful for dating fossils?
- P32 – 14.2 days
 - H3 – 4500 days
 - C14 – 5740 years
 - U235 – 700 million years
70. Continental plates sliding sideways past each other often result in
- Seafloor spreading
 - Earthquakes
 - Rifting
 - Subduction
71. The best-preserved animal remains are found in
- Tar
 - Rock
 - Water
 - Solidified magma
72. A lesson on fossils incorporating a lab during which rocks are classified would most benefit
- Auditory learners
 - Visual learners
 - Kinesthetic learners
 - Slow learners

73. In a lab experiment, students are presented with three types of flowers, some with stamens, some with pistils, and some with both. They conclude that all flowers have at least one kind of reproductive structure. They are engaging in

- a. Deductive reasoning
- b. Inductive reasoning
- c. Indirect instruction
- d. Causal reasoning

74. During a lesson, teachers should keep in mind that the most effective way to present information is to

- a. Understand, organize, and remember information
- b. Organize, emphasize, and understand information
- c. Emphasize, understand, and remember information
- d. Organize, understand, and remember information

75. In a lesson on invertebrates, an instructor plans to show the students the fly eye. He has dissected a fly and mounted a sample on a slide, but the students aren't able to make out the structure. He should advise his students to

- a. Find pictures of the fly eye in a book
- b. Use a more powerful magnification on the microscope
- c. Stain the specimen
- d. Place the specimen on a dark background

76. In terms of mass, which of the following represents the greatest amount of sucrose (Molar mass = 342 grams)?

- a. 1 mole
- b. 100 grams
- c. 1 L of a 0.1 M solution
- d. 100 mL of a 1 M solution

77. A student's science fair project involves studying the effects of fertilizer on grass height. After four weeks of measuring height weekly, the student was not able to tell any difference between two pots of grass he had fertilized and watered weekly. How could this experiment be improved?

- a. Measure height more frequently
- b. Only water one of the pots
- c. Use a more accurate method of measurement
- d. Only fertilize one of the pots

78. Which of the following would be most useful in providing a summative assessment?

- a. Student lab reports
- b. Quizzes and essays
- c. Standardized entrance exams
- d. Anecdotal records

79. Individual testing is appropriate when
- a. Students are being tested on qualitative rather than quantitative subjects.
 - b. A student has linguistic barriers.
 - c. Time and resources are limited.
 - d. The student needs a re-test.
80. All of the following teacher behaviors are motivating to students except
- a. Modeling positive expectations and attributes
 - b. Having a supply of incentives, such as rewards
 - c. Placing students in one-on-one competition in front of their peers
 - d. Goal setting, combined with self-appraisal and reinforcement

Answer Key

1.	B	45.	C
2.	D	46.	A
3.	C	47.	C
4.	A	48.	D
5.	B	49.	C
6.	C	50.	B
7.	D	51.	A
8.	C	52.	D
9.	D	53.	C
10.	A	54.	B
11.	A	55.	A
12.	B	56.	B
13.	C	57.	A
14.	C	58.	A
15.	A	59.	C
16.	A	60.	A
17.	D	61.	D
18.	B	62.	C
19.	B	63.	D
20.	A	64.	B
21.	C	65.	C
22.	B	66.	A
23.	B	67.	D
24.	C	68.	B
25.	B	69.	D
26.	C	70.	B
27.	D	71.	A
28.	A	72.	C
29.	C	73.	B
30.	B	74.	D
31.	C	75.	C
32.	B	76.	A
33.	D	77.	D
34.	A	78.	C
35.	A	79.	B
36.	B	80.	C
37.	C		
38.	D		
39.	B		
40.	C		
41.	B		
42.	B		
43.	D		
44.	A		

Answer Explanations

1. B: Benzene, an organic compound, is classified as a carcinogen by the U.S. Department of Health and Human Services. The chemical has been linked to kidney cancer, leukemia, and other health problems. For that reason, benzene is not allowed in school laboratories. Lead a. can harm individuals, particularly children, if ingested, but is not considered a carcinogen. Aspartame c. is an artificial sweetener found in many foods and beverages. Methanol d., or methyl alcohol, can be fatal if ingested, but is not considered a potential carcinogen.

2. D: Centrifugation is a technique used in laboratories and by industries to separate mixtures, including blood. The force exerted during rotation or spinning (centrifugal force) causes mixtures to separate according to their densities. In the case of blood, the denser red blood cells will settle on the bottom of the tube, while the less dense serum will remain on top. Spectroscopy a. involves studying matter by analyzing emissions, while sublimation b. is a change in a state of matter. Microscopy c. involves the use of microscopes.

3. C: 100 grams represents the largest quantity. To solve a problem like this, it is often helpful to convert all answer choices to one quantity. 10 decigrams a. is equal to 1 gram ($10 \text{ decigrams} \times 0.1 \text{ grams/decigram} = 1 \text{ gram}$). 100 milligrams b. is equal to 0.1 grams ($100 \text{ milligrams} \times 0.001 \text{ grams/milligram} = 0.1 \text{ grams}$). 1 decagram d. is equal to 10 grams ($1 \text{ decagram} \times 10 \text{ grams/decagram} = 10 \text{ grams}$). All of these quantities are smaller than c., 100 grams.

4. A: Creating a chart from collected data is a way to present information visually. Bar graphs, pie charts, histograms, organizational charts, and flow charts are all considered visual representations of data. Simply charting data does not involve making any conclusions b. The raw data is what is being used to construct the chart. It doesn't need to be charted to be raw data, making c. incorrect. Charting this data does not involve analyzing it or comparing it to anything else, making d. incorrect.

5. B: Evidence used to make a scientific conclusion must be reproducible, meaning the same results would occur time and again if an experiment was repeated. The boiling point of water, for instance, always remains the same, regardless of where, when, or how many times it is measured. Evidence used to make scientific conclusions can be quantitative or qualitative, making a. incorrect, and evidence doesn't have to be obvious to be valid, making c. an incorrect choice. Since a. and c. are incorrect, d. is also incorrect.

6. C: By repeating the experiment, the researcher could determine whether the instance of the bacteria swimming away from the chemical was simply due to chance. Observing the same results would allow the researcher to make conclusions with more certainty, and statistical analysis would help determine the significance of the data. Researchers must report all data a., and reaching a conclusion is a vital part of any experiment b. Adding a new chemical would completely change the experiment, so it would not be helpful d.

7. D: The binomial system of nomenclature was developed by Carl Von Linnaeus in the mid 18th-century. This system named organisms according to their genus name and their species name. Humans, for instance, are known as *Homo sapiens*. Pasteur a. , Darwin b. , and Mendel c. , made important discoveries regarding disease, evolution, and genetics, respectively. None of these men were even born until the 19th century, making Linnaeus's contributions to science the first.

8. C: When there is a correlation, it means that variables are related. A change in one is associated with a change in the other. In this case, the variables are stomach ulcers and coffee consumption (no coffee consumption is associated with fewer stomach ulcers, and vice versa). A controlled experiment would involve controlling the exact amount of coffee consumption a., and there is not enough data to conclude that coffee causes ulcers b. There is nothing to suggest biases in measurement (systematic error) making d. incorrect.

9. D: A renewable resource is one that can be replaced at a rate that is similar to or equal to its rate of consumption by humans. Cash crops can be grown in a reasonable amount of time, and fields can be replenished with bananas, corn, coffee, etc. to meet demand. Trees a. that are cut down take many years to grow back, and cannot really be considered a renewable resource. Ore minerals b. and fossil fuels c. would take thousands or millions of years to be replenished.

10. A: A shortage of habitable land was never a factor that stopped the human population from increasing. Even today, North America has only about 32 people per square mile, so land availability has never been a huge problem. Advances in agriculture b. allowed more food to be produced on the same amount of land. Better food availability was a factor in population growth, as was improved sanitation c. , which resulted in less sickness and disease. Understanding the causes of communicable diseases d. resulted in fewer deaths.

11. A: Pure water will always freeze at the same temperature: 0° Celsius, or 32° Fahrenheit. The temperature at which iron ore will melt b. varies depending on the types of impurities that are present in the substance. The human population size c. has been changing ever since humans first inhabited the earth. The time the sun rises, d. varies according to the time of year and the location of the observer.

12. B: Chemical reactions are non-reversible. In addition, the byproducts or substances that are created are not the same as the original substances. When ethanol is burned, it reacts with the surrounding oxygen to produce carbon dioxide and water, two totally different substances. Evaporation a. is a physical change since it can be reversed. Dissolving salt in water c. is also reversible, and nothing new is created. Freezing water d. is also an example of a physical change. Only the water's state of matter has changed.

13. C: The most basic units of matter are protons, electrons, and neutrons. Protons are found in the nucleus, and have a positive charge. They are one of the three components of a helium atom a. When atoms have positive or negative charges, they are known as ions b. Molecules of oxygen, water, etc. d. are even more complex, consisting of one or more atoms held together by bonds.

14. C: A mathematical model is a depiction of a device or process that involves a number of variables. It often involves developing equations to describe a process or system. In this instance, the person developing the model is trying to determine the relationship between two variables (force and the length of the spring), and an equation could likely be developed to illustrate this relationship. The other choices involve determining position and rate. These are simple measurements, and would not require models or equations.

15. A: Newton's first law (commonly known as the law of inertia) states that an object in motion tends to stay in motion and an object at rest tends to stay at rest unless a force is applied. Inertia b. isn't what is being applied to the object, but the name of the concept. Gravity c. is a force that can cause an object to start or stop moving, but it is only one of many. Acceleration d. is a measure of an object's increase in velocity.

16. A: Velocity measures not only the speed of an object, but also its displacement. Since the starting point and ending point of the car are the same, the displacement is zero. Therefore, the velocity is also zero. Answers b., c., and d. are all incorrect since they don't accurately represent the displacement of the vehicle. Additionally, since 50 miles/hour d. was the top speed of the car, it couldn't represent the average velocity.

17. D: An object's weight is actually a measure of the gravitational force acting on that object. In this case, as the meteorite moves towards earth's surface, the gravitational force on it would be greater. In other words, it would weigh more. The mass of the meteorite a. refers to the amount of matter it contains, which remains the same regardless of its location. Volume b. (the amount of space the meteorite occupies) and density c. (mass per unit of volume) would also stay the same.

18. B: This is related to Newton's second law of motion, expressed as $F = m \cdot a$. To determine whether the statement is true, let the value of "a" be 2. Let the mass of the first block be 1 ($F = 2$). The mass of the second block is 2. Therefore, $F = 2 \cdot 2$; $F = 4$. It would take twice as much force, not three times as much. a. and c. are examples of the law of inertia. d. is an example of Newton's third law.

19. B: Heating a liquid is most likely to change its density, a measure of mass per unit of volume. Water, for instance, has a density of 1g/cm^3 at 4°C . As it is heated and molecules become more spread apart, the density decreases. In general, liquids do not have a crystal structure a. A liquid's mass, or the amount of matter it contains c. , will not change according to temperature, nor will its electrical conductivity d.

20. A: Dissolving a seltzer tablet in water is an example of a chemical change since a new substance is produced. In this case, carbon dioxide is produced as a result of the reaction. Grinding pepper b. and freezing water c. merely changes the form of these substances, not their composition. Churning butter d. is a physical change. The globules of milk fat are broken apart so they can clump together and form butter. Although butter looks different than cream, they are composed of the same substances.

21. C: Nonmetal ions are negatively charged, while metal ions are positively charged. Because of these opposite charges, they readily bond and react. The metal iron, for instance, reacts readily with the nonmetal oxygen to form rust. As a general rule, nonmetals are considered non conductors a.. Nonmetals, including oxygen, can form isotopes b. Nonmetals typically have low densities, are not hard, and have low melting points d.

22. B: The vertical rows on the period table are known as groups. All elements in the same group will have similar electron shell configurations, which plays a key role in chemical reactivity. The horizontal rows a. and c. of the periodic table are known as periods. Although elements in a period may have similar atomic weights and numbers, their chemical reactivity may be quite different. Since b. is correct, d. is incorrect.

23. B: Isotopes are different configurations of the same element, and are distinguished by the number of neutrons they contain. Oxygen-16, oxygen-17, and oxygen-18 isotopes, for example, have 8 protons each and 8, 9, and 10 neutrons, respectively. The number of protons a. and electrons c. does not vary in an element's isotopes. Leptons d. are the elementary particles that make up matter (electrons, neutrinos, muons, and taus). Their numbers don't vary among different isotopes.

24. C: The electrons that are present in an atom's outermost electron shell are gained or lost during a reaction. Consider the reaction between sodium and chlorine as an example. Sodium has one valence electron; chlorine has seven. When they react, sodium gives up an electron and chlorine gains one. Both outermost electron shells are full. Protons a. and neutrons b. are in an atom's nucleus, and therefore are not exchanged during a chemical reaction. Isotopes d. are different configurations of an atom.

25. B: Acetic acid is a weak organic acid with a chemical formula of CH_3COOH . It is characterized by its sour taste and strong smell. Vinegar is a diluted form of acetic acid. Cream of tartar a. is a type of acid salt used in cooking. Its chemical formula is $\text{KC}_4\text{H}_5\text{O}_6$, and it does not contain acetic acid. Baking powder c. is a mixture of a salt and an acid, but it does not contain acetic acid. Water d. is neutral and its formula is H_2O .

26. C: Photosynthesis can be represented by the following equation: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$. A reduction reaction transforms CO_2 into glucose ($\text{C}_6\text{H}_{12}\text{O}_6$), a type of carbohydrate. An oxidation reaction a. is what transforms the water into oxygen. Chemiosmosis b. describes the movement of ions across cell membranes, and hydrolysis d. is a type of reaction in which water is separated into hydrogen and hydroxide ions.

27. D: The equation used to calculate an object's potential energy is $E = m * g * z$. In this equation, m represents the object's mass a., g represents the acceleration of gravity b., and z represents the height of the object c. The temperature of the object does not play a role in the amount of potential energy it contains, making d. the correct answer choice.

28. A: Joules is the unit used to measure thermal, electrical, and mechanical energy, and is defined as the amount of work required to move an object 1 meter using a force of 1 Newton (1 Joule = 1 $\text{N} * \text{m}$). Volts b. is used to measure voltage, ohms c. is used to measure resistance, and amperes d. is used to measure current. All of the choices except a. are units related to electricity.

29. C: The leaves on a tree appear to be green because that is the color of the light that is being reflected. All other colors are absorbed a. , and are not perceived by the human eye. Refraction b. is

when light bends slightly, usually when it enters one medium from another. Diffraction d. is when light bends around obstacles or spreads out after it passes through a small opening.

30. B: Sound can be defined as the vibration of particles, whether those particles are present in a gas, liquid, or solid. The fact that sound requires particles is illustrated by the fact that sound cannot travel through a vacuum. Radio waves a. , microwaves c. , and X-rays d. are all types of electromagnetic rays. They can travel in vacuums, and do not require particles to propagate.

31. C: The sun is mainly composed of hydrogen and helium. During nuclear fusion reactions, hydrogen is transformed into helium and energy that is released in the form of visible light. This reaction produces 85% of the sun's energy. Hydrogen is transformed into helium, not the other way around a. Lithium produces helium only, and is not the primary process that creates sunlight b. Helium does form beryllium and a gamma ray, but is not how most of the sun's light is produced.

32. B: The water at the surface of the ocean will usually be slightly warmer than the air. It evaporates, enters the air, and then rises, making the atmosphere slightly warmer. Radiation a. is the active emitting of energy from an object. Thermoregulation c. is the ability of an organism to control its body temperature. Transduction d. is the transfer of DNA among different bacteria by viruses.

33. D: By measuring the mass of the wood before and after burning and then calculating the difference between the two masses, the amount of matter lost during burning can be determined. Since different types of gases with different molecular weights are released, calculating the total number of molecules would not allow the mass to be calculated a. The gases emitted combine with oxygen in the air, making b. an unsuitable approach. The weight of the ash alone c. wouldn't be helpful without knowing the original mass.

34. A: Heat that is removed from the air is emitted by the fridge, usually at the back. Since the process is not 100% efficient and requires electrical energy, the fridge will emit slightly more heat than it removes. The temperature will not decrease b. since heat removed from the air is being emitted, and the temperature would only remain the same c. if the fridge was 100% efficient. The size of the room d. does not matter since the question is asking what would eventually happen.

35. A: The nucleolus is located in the nucleus of the cell, and is responsible for the transcription and assembly of r-RNA. Roughly spherical in shape, this organelle is not surrounded by any type of membrane. Chromoplasts b., mitochondria c., and endoplasmic reticulum d. can all be classified as membrane bound organelles. They are responsible for storing and synthesizing pigments, energy production, and the transportation of proteins, respectively.

36. B: Cells are the basic units of life, and all organisms have them. Some organisms like bacteria have just a single cell, while complex organisms like humans have hundreds of trillions. Prokaryotes do not have organelles a. Not all organisms have tissues, groups of cells that make up connective tissue, muscle tissue, etc. Finally, only some types of cells, including plant cells, have cell walls d.

37. C: Organisms that thrive in environments where other living things could not survive – such as around hot thermal vents found under the sea – are often known as extremophiles. These organisms are typically microorganisms like bacteria, which are prokaryotes. Protists a., are classified as eukaryotes b., which are not typically found in extreme environments. Metazoans d. are

multi-cellular, eukaryotic organisms. Like all eukaryotes, metazoans do not thrive near thermal vents or in other extreme environments.

38. D. Endorphins are a special group of neurotransmitters. When an injury occurs, endorphins are released, and are capable of reducing the severity of pain. They are also released during intense exercise and periods of intense relaxation. Acetylcholine a., also a neurotransmitter, activates muscles and plays a role in attention and sensory perception. Oxytocin b. plays a crucial role in female reproduction. Luteinizing hormone c. plays an important role in female ovulation and testosterone production in males.

39. B: When there is a wound, platelets travel to the injury site and gather there to block the flow of blood from the body. The platelets have a sticky surface and react with the air to form a scab. Plasma a. is the liquid part of the blood in which cells are suspended. Erythrocytes c., or red blood cells, transport oxygen throughout the body. Leukocytes d. or white blood cells, help the body defend against infectious disease.

40. C: Polymers consist of repeating units that are joined together by covalent bonds. Cellulose a. is a type of carbohydrate polymer consisting of hundreds of even thousands of glucose units. DNA b. consists of two polymer strands composed of nucleotides. Proteins d. are polymers composed of amino acids. Phospholipids are part of cell membranes, and consist of a hydrophilic head and a hydrophobic tail. These lipids do not form polymers.

41. B: Asexual reproduction means that offspring are produced by a single parent. Yeast cells reproduce asexually through budding. The genetic material of the cell is copied, and a small bud forms on the outside of the yeast cell. It grows and eventually breaks away, forming a new yeast cell. Most organisms, including ferns a., flowering plants c., and trees d. require two parents to produce seeds, spores, etc. In other words, they are not capable of asexual reproduction.

42. B: Since all of the offspring are purple, the purple allele must be dominant, and the purple plant must be homozygous. The Punnett square would look like this (R is purple, r is white):

	R	R
r	Rr	Rr
r	Rr	Rr

If purple was recessive a. to white (white was dominant), at least some of the plants would be white. If the alleles were codominant c., the flowers would be light purple or contain both colors. Since b. is correct, d. is incorrect.

43. D. Sex-linked traits are associated with the X chromosome. Since it is recessive, the mother must have two copies of the recessive gene (X^cX^c). The father is not colorblind, and since only the X chromosome carries the allele, his genotype is X^cY . All daughters will have the genotype X^cX^c . Since colorblindness (c) is recessive, none of the daughters will be colorblind, although they will all carry the allele for color blindness.

44. A: Cloning genes involves making copies of DNA fragments. To do this successfully, researchers much have cDNA, also known as complementary DNA. It is copied from messenger RNA, and includes all of the DNA in a gene, molecule, cell, or organism. In genetics, expression profiling b. involves measuring the activity of thousands of genes simultaneously. All DNA is transcribed in the same manner c., and phenotypes d. are physical traits associated with genes.

45. C: Rhinoceros horns and human hair are both made of compressed fibers of keratin. They are homologous characteristics, meaning they are inherited from a common ancestor, even though they may serve various functions in different species. Ancestral characteristics a. are unmodified characteristics found in common ancestors, not the species that developed from them. Detrimental characteristics b. are those that interfere with normal functioning or threaten an organism's survival. Analogous characteristics d. are not evolutionarily related, but serve similar functions in different species.

46. A: According to natural selection, organisms with traits that are well suited to their environments are the ones that survive. In this instance, gray moths were able to blend in with soot-covered trees better than white moths. Therefore, the gray moths survived and reproduced. Genetic drift b. refers to the random changes in gene frequencies over time. Sexual selection c. refers to the fact that organisms compete for or choose mates. Punctuated equilibrium d. states that evolution occurs quickly after long periods of little change.

47. C: Finches with beaks well-suited for the types of food available on an island had an evolutionary advantage. As a result, these finches survived and reproduced, a phenomenon known as natural selection. The finches share a common ancestor, regardless of the island on which they now live a.. Genetic drift refers to genetic changes that occur due to random chance; this would not account for different beaks on different islands b. Introduction by humans would not account for different beaks d., since phenotypes change over time.

48. D: Population size is not relevant when determining an organism's evolutionary history. Population sizes vary over time according to many factors, so no real conclusions can be drawn from this information. Fossil record placement a. can help determine when species developed and how they are related to other organisms. Studying an organism's anatomy b. is useful because ancestors can be identified by looking at physical characteristics like bone structure and appendages. Studying distribution among continents d. can help determine where an organism originated.

49. C: In this example, the stimulus is the touching of the leaves. The response is the plant's rapid crumpling of its leaves. If the stimulus is absent, the response does not occur. Innate behaviors a. are ones an animal is born with. They are not learned. The term is not used in relation to plants. Learned behaviors b. are acquired through observation, practice, and instruction. Plants are not capable of learning. A single cell response d. involves just one cell; a plant's leaves consist of many.

50. B: The circulatory system carries blood throughout the body, and plays an important role in controlling body temperature. Capillaries below the skin contract or expand to release or contain body heat. Heat is also transported from hotter parts to colder parts to ensure an even body temperature. The skeletal system a. protects organs and provides the body with its structure and shape. The immune system c. helps fight off illnesses and infections. The muscular system d. is what allows the body to move.

51. A: Maintaining homeostasis means that conditions are kept stable and relatively constant. Negative feedback is a mechanism used to reverse or minimize changes in a system. In this example, negative feedback is used to keep the body's glucose and insulin levels stable. Positive feedback b. is a mechanism that increases changes in a system. A stress response c. describes the body's reaction to threats or pressures. Parasympathetic regulation d. refers to activities of the nervous system, including slowing the heart rate and boosting intestinal activity.

52. D: Commensalism describes a relationship in which one organism benefits while the other is not affected. In this instance, the orchid benefits from the extra sunlight and nutrients, but the tree is neither helped nor harmed. Mutualism a. describes a relationship in which both organisms benefit. The organisms are not in competition b., since the leaves of the trees receive sunlight and the roots collect nutrients from the soil. In a parasitic relationship c., one organism is harmed.

53. C: An ecosystem is an environment that includes both the physical environment and the plants, animals, and other organisms that reside within it. By definition, an ecosystem consists of both the abiotic a. and biotic environment. An ecosystem does not need to contain a collection of population b.; it could consist of an environment with only one population. Ecosystems can (and often do) contain more than a single species d.

54. B: Biome is a term often used interchangeably with ecosystem. It is a community of plants and animals. Some types of biomes are oceans, deserts, and forests. Organisms in a biome will be evolutionarily related since they thrive in the same environment. Biome populations are interconnected, and species depend on each other for survival a. The biosphere is defined as all of the earth's ecosystems c. Species in a biome are interdependent; they don't evolve independently d.

55. A: Carrying capacity is defined as the size of a population an environment can support indefinitely. Food, water, and suitable habitat are all needed. Once any of these resources is exhausted, a population can no longer increase. An organism's size b. does not determine the size of the population. In suitable conditions, numbers of organisms (regardless of size) will increase. Neighboring communities c. are not important; only the organism's environment is. The type of biome d. doesn't matter if conditions are suitable for a species.

56. B: A primary consumer is an organism that feeds on plants. Herbivores (plant eaters) like mice are considered primary consumers. Primary producers a. are at the bottom of the food chain, and include plants. They are a food source for primary consumers. A secondary consumer c. relies on primary consumers for food. If a fox ate the mouse, the fox would be a secondary consumer. Decomposers d. rely on dead organisms for food, and include bacteria and fungi.

57. A: The term population is used to refer to a collection of a single species. In this case, the bacteria in the middle ear would be classified as a population. For a community b. to be formed, there would have to be more than one type of species present. An ecosystem c. would require a community of organisms living in a natural environment on land or in the water. All of the bacteria would not form individuals d. . Instead, the individuals form a population.

58. A: During volcanic eruptions, magma is expelled. As a result, the emptied area is not able to support the rock above it. It collapses, creating a crater-like formation known as a caldera. Calderas are created when rocks move down, not up b. A caldera is not a class of volcano c.; it is a volcanic feature that occasionally forms after eruptions. It is not the cooling of lava d. that accounts for calderas, but rather the expulsion of magma.

59. C: Currents are basically the horizontal movement of water in the earth's oceans. Numerous forces act on the oceans to produce currents. Wind a. blowing on the surface causes movement because it pushes the water. Water heated by the sun expands d., which causes movement, and the moon is responsible for the ocean's tides and the resulting tidal currents. Ice cap and glacial melting c. causes ocean levels to rise vertically, but does not influence the horizontal movement of ocean water.

60. A: The vast majority of the earth (approximately 70%) b. is covered in water. Therefore, approximately 30% of the earth is solid land. Of all the water on earth, only about 2% of that is fresh water, and most of that is present in glaciers and the polar ice caps. Therefore 98% (100% - 2%) of the earth's water is the salt water (saline) found in the oceans.

61. D: Metamorphic rock is found deep beneath the surface of the earth, and is an important component of the earth's crust. This type of rock is formed at temperatures of up to 200°C. The formation also requires great amounts of pressure, which is often exerted by layers above the metamorphic rock. Sedimentary rock a. is formed by particles that settle on land or in water. Igneous rock b. is cooled, solidified magma, and the term composite c. does not describe a type of rock.

62. C: The carbon cycle is defined as the movement of the earth's carbon through organisms, oceans, air, rocks, and soil. Animals breathe out carbon dioxide during respiration a., which deposits carbon into the air. Carbon from the atmosphere is dissolved in sea water, and can settle on the ocean floor. This collected matter is known as sedimentation b. When organisms die, the carbon in their bodies is returned to the soil through decomposition d. Transpiration, the process by which plants lose water, does not transport carbon.

63. D: Nitrogen is abundant in the earth's atmosphere, but is not in a form that organisms can use. Nitrogen fixing refers to the conversion of nitrogen in the atmosphere to ammonia. Organisms require this form of nitrogen to synthesize DNA and proteins, and only nitrogen-fixing bacteria are capable of carrying out this conversion. Photosynthesis a. produces glucose and oxygen, and rocks do not leach b. nitrogen that can be used. Nitrogen is essential to decomposition c., but the process doesn't provide a usable source of the element.

64. B: As the earth travels around the sun, it tilts towards the sun or away from it, depending on where it is in its orbit. This tilt is what determines the seasons. The earth is tilted towards the sun in summer and away from it in winter. Elevation a. and latitude c. of an area remain constant throughout the year, so they cannot account for the changing of the seasons. Air masses d. can influence the weather, but don't determine the seasons.

65. C: Dew is condensed water from the air. The point at which vapor in the air transforms into liquid is known as the dew point. Relative humidity a. is a measurement used to express the amount of water vapor in the air. Barometric pressure b. is the amount of pressure exerted by the atmosphere as a result of its weight. The Gulf Stream d. is an ocean current that warms the climate of some countries.

66. A: Most of the sun's energy is produced by a nuclear fusion reaction. During these reactions, hydrogen atoms react to produce helium and energy, which we perceive as visible light. Nuclear fission occurs when atoms are broken apart b. Nucleation c. is a process that occurs during the

formation of crystals, and hydrogenation d. is the reaction that results when H_2 is added to a solution.

67. D: When a star begins running out of fuel and its temperature decreases, it cannot resist its own gravity, and collapses in on itself. This is known as a black hole. Nothing, not even light, can escape from black holes. Quasars a. are observed in the center of very young galaxies and emit energy. Pulsars b., like black holes, are the remnants of stars. Unlike black holes, however, they emit light. Dark matter c. is matter that is thought to exist, but is not readily detectable.

68. B: A comet is an irregularly-shaped solar system body that has a large nucleus and a tail that appears to trail behind. Comets are composed of rock, ice, cosmic dust, and frozen gases such as methane and carbon dioxide. a. would be an accurate description of the sun. c. is a description of a meteoroid. Massive satellites that orbit planets are also commonly known as moons d.

69. D: A half life of a radioactive isotope is the length of time it takes for the amount of an isotope present to decline by half. Some animal fossils are hundreds of millions of years old. Therefore, a U235 isotope would be most useful since it has the greatest half life. If one gram was present initially, half a gram would still be present after 700 million years. The half lives of a., b., and c. are too short to date very old fossils.

70. B: Continental plates have irregular boundaries. When they move past each other, the edges can lock together. The rest of the plates still move somewhat, though, which creates stress and stored energy. When the plates do finally become unlocked, energy is released, creating an earthquake. Seafloor spreading a. is the formation of new ocean crust via earthquakes. Rifting c. is a split in the earth's surface caused by continental plates separating. Subduction d. is when one continental plate moves under another.

71. A: Tar can preserve the teeth and bones of animals, as well as the outer bodies of insects. The preserved bones of many animals have been found in numerous tar pits, including the famous La Brea tar pit in California. Fossils that form on rock b. are simply impressions left by plants and animals. They are not actual remains. Animal remains would not be preserved in water c., and magma would completely destroy animal remains before it solidified.

72. C: Kinesthetic learners benefit most from hands-on activities during which they can touch and manipulate objects. Therefore, an activity in the lab would be quite beneficial. Auditory learners learn best by listening to information a., while visual learners b. benefit when information is presented in the form of pictures, graphs, and other visual representations. Slow learners d. perform at a lower than average level. There is nothing about the lab activity that would benefit this group in particular.

73. B: Inductive reasoning involves using direct observations to make a general conclusion. In this case, students concluded that since the flowers they observed had one or two reproductive structures, all flowers must have at least one. Deductive reasoning a. involves using general information to make a conclusion about something more specific. Indirect instruction c. is a method used by teachers, while causal reasoning d. attempts to explain the cause of a particular event or phenomenon.

74. D: Organizing information first tells students what they will be learning and establishes how it will be covered. Then, methods are used to help students understand the topics presented. Finally,

the instructor must help students remember the information by reinforcing it through practice, examples, activities, etc. Information cannot really be understood before it is organized a., and emphasizing information is not effective if students don't understand it first or it is not taught at all b. and c.

75. C: Many biological specimens are not visible because the cells are fairly transparent. Staining the specimen will color the cells so they can be viewed and studied more easily. Finding a picture in a book a. is not a suitable solution since the purpose is to view the actual specimen. A more powerful magnification b. wouldn't solve the problem since it wouldn't make the transparent specimen any more visible. Placing the specimen on a dark background d. would not help since it would still be transparent.

76. A: Since the molar mass of sucrose is 342 grams, one mole weighs 342 grams. This is greater than 100 grams b. In one liter of a 0.1 M solution c. there are 34.2 grams of sucrose. ($1 \text{ liter} \times 0.1 \text{ moles/liter} = 0.1 \text{ moles}$; $0.1 \text{ moles} \times 342 \text{ grams/mole} = 34.2 \text{ grams}$) In 100 ml (0.1 liters) of a 1 M solution d. , there are 34.2 grams of sucrose. ($0.1 \text{ liter} \times 1 \text{ moles/liter} = 0.1 \text{ moles}$; $0.1 \text{ moles} \times 342 \text{ grams/mole} = 34.2 \text{ grams}$)

77. D: In order to investigate the effects of fertilizer on grass height, the student needs to have a control sample. He should only fertilize one pot so he can compare the differences in growth between the two. Measuring more frequently a. and accurately c. would still not allow him to make any conclusions since there is no control sample. The student is investigating the effect of fertilizer, not water b., so both plants must be given equal amounts of water.

78. B: A summative assessment is conducted after a certain amount of learning takes place. These types of assessments are used to measure whether a student possesses the knowledge and skills taught during a unit or course. Periodic quizzes and essays are useful for conducting summative assessments. Lab reports a. are formative assessments, which are completed during a course or specific unit. Entrance exams c. and anecdotal records d. would be completed before any learning took place.

79. B: Individual testing typically involves one-on-one interaction with the student. This would be a good approach for a student whose first language is not English, since questions could be read to the student and explained. Group testing is an equally appropriate approach to assess knowledge of qualitative and quantitative information a. A teacher would need extra time and resources c. to conduct individual testing, and a re-test d. would typically be completed in the same way as the original.

80. C: Making students compete in front of others will likely be more harmful than helpful, particularly for students who are shy or struggling academically. Most students would not be motivated by this approach. Having positive expectations and modeling desirable attributes a. , offering incentives for meeting certain goals b. , and setting attainable goals for students d. are all approaches that can motivate students at all grade levels.