



2018 State STEM Competition

Middle School Science Test

Student Instructions

- This test is for students in 6th, 7th and 8th grades. If you are not in one of those grades, work with a test proctor to find the appropriate test.
- Leave the test booklet closed and wait until the proctor tells you to start.
- The test period will be 45 minutes and this test contains 60 multiple choice questions.
- This test includes topics covered in all middle school science classes. The questions range in difficulty from easy to very challenging. Most students will NOT be familiar with all of the material on their test.
- There is no penalty for skipping a problem or answering incorrectly.
- You may write on this test. If you need scratch paper, please raise your hand and ask for some.
- Your score will be determined by the number of correct answers. All ties will be broken by awarding the place to the student having the most consecutive correct answers from the start of the test.
- You will not be permitted to leave the room while the test is in progress. If you finish early, you must remain in the room quietly until the test is completed. Any student causing a disturbance will be disqualified.
- **LEGIBLY** write your name, grade, and school on the right side of the answer/Scantron sheet, as shown below -

NAME	Your First and Last Name		
SUBJECT	Your Grade	TEST NO.	Test Name
DATE	School Name	PERIOD	

- Answers must be marked on the answer/Scantron sheet with a number two pencil.
- All tests must be turned in at the end of the testing period. Tests may not be taken from the testing room.

GOOD LUCK!

Answer the following questions by marking the **BEST** answer on the answer sheet.

- (1) Two equal in magnitude, but opposite in direction, forces acting on an object will always cause an object that is moving to
 A) turn. C) come to a stop.
 B) continue to move at a constant speed. D) slow down.
- (2) Which of the following has the largest magnitude of momentum?
 A) a hummingbird flying at 30 m/s C) a school bus parked and waiting
 B) a mature gorilla hanging from a branch D) a leopard moving at 30 m/s
- (3) Volcanic eruptions originate in which layer of the Earth?
 A) inner core C) mantle
 B) troposphere D) crust
- (4) What is a group of ecosystems with similar climates and organisms?
 A) community C) habitat
 B) biome D) ecosystem
- (5) The genetic material, DNA, is found in
 A) cells. C) atoms.
 B) ions. D) electrons and protons, but not neutrons.
- (6) Each student in Ms. Henson's science class was given a beaker containing several substances that had been stirred thoroughly. A student must classify the contents of his beaker as either a compound or a mixture. Which of the following would indicate that the beaker contains a mixture?
 A) The original substances had different densities.
 B) The contents of the beaker reacted to form a new substance.
 C) The original substances had a greater mass than the contents of the beaker.
 D) The contents of the beaker can be easily separated into the original substances.
- (7) Which best describes two organ systems working together to help maintain homeostasis?
 A) The reproductive organs produce sex cells.
 B) The nerves carry signals from the eye to the brain.
 C) The bones and muscles of the hand work together to grip a pencil.
 D) The muscles of the chest tighten to push carbon dioxide out of the lungs.
- (8) A spring scale is pulled downward and readings (shown to the right) are recorded. If the spring is pulled 3.5 cm, the spring scale should read what amount?

Data Table

Distance Pulled	Spring Scale Reading
1.0 cm	4 N
1.5 cm	6 N
2.0 cm	8 N
2.5 cm	10 N

- (9) Which unit of measurement would be the best for measuring distance between atoms?
 A) nanometer C) millimeter
 B) kilometer D) inches

- (10) Which of the following best describes an atom?
- A) a core of protons and neutrons surrounded by electrons
 - B) a core of electrons and neutrons surrounded by protons
 - C) protons and electrons grouped together in a random pattern
 - D) protons and electrons grouped together in an alternating pattern
- (11) What do the elements sulfur (S), nitrogen (N), phosphorus (P), and bromine (Br) have in common?
- A) They are noble (inert) gases.
 - B) They have the same thermal conductivity.
 - C) They are nonmetals.
 - D) They have the same number of protons.
- (12) If the temperature of Earth rose over time, which of the following would occur?
- A) The sea level would fall, and the polar ice caps would decrease in size.
 - B) The sea level would fall, and the polar ice caps would increase in size.
 - C) The sea level would rise, and the polar ice caps would decrease in size.
 - D) The sea level would rise, and the polar ice caps would increase in size.
- (13) Which of these is an immediate result of the movement of tectonic plates?
- A) ocean currents
 - B) earthquakes
 - C) glacier movements
 - D) tides
- (14) Noah bought a small turtle. Three months later, the turtle had grown to twice its original size. Which of the following statements best describes why Noah's turtle got bigger?
- A) Parts of the turtle stretched out as it grew larger.
 - B) The number of cells in the turtle's body increased.
 - C) The turtle's body absorbed the food it ate and water it drank.
 - D) The size of each cell in the turtle's body got bigger as it got older.
- (15) Which of the following is not true of genes?
- A) Genes often lead to the production of a protein.
 - B) They can come in dominant or recessive forms.
 - C) Most of the DNA sequences in chromosomes are genes.
 - D) They are passed from generation to generation through chromosomes.
- (16) The darker portion of the Moon that faces the Earth in a crescent phase often appears somewhat lighted with a faint grayish glow. Which of the following best describes why this happens?
- A) an optical illusion
 - B) afterglow of the Moon's lighted surface
 - C) sunlight reflected off interplanetary dust
 - D) sunlight reflected off the Earth's surface onto the Moon
- (17) Which statement is the best description of what happens in the rock cycle?
- A) Rocks on old mountains are gradually weathered away while mountain building and volcanism form new mountains.
 - B) Once formed, rocks stay in place until rocks above them are weathered away, and they reach the surface.
 - C) As sedimentary rocks are buried deep below other rocks, heat and pressure change them, eventually return to the surface and are weathered again.
 - D) Younger sedimentary rocks are always deposited on top of older metamorphic or igneous rocks.

- (18) Liz took a large beaker of clean water and carefully added one drop of blue food coloring to the edge of the water's surface. She did not touch or move the beaker. At first, she saw blue streaks as the food coloring sank into the water, but gradually the color of the entire beaker of water became evenly blue. What caused the blue food coloring to be mixed throughout the water?
- A) Light shining on the surface of the water caused the mixing.
 B) Water molecules hitting the food coloring molecules caused the mixing.
 C) The water interacted with the food coloring, causing the blue color to fade.
 D) A chemical reaction between the water and the food coloring formed a new, light blue compound.

- (19) The table to the right shows five elements and the way they react with chlorine (Cl). Which two elements are most likely from the same family or group in the periodic table?

Element	Compound Formed when Reacted with Chlorine
Sodium (Na)	NaCl
Aluminum (Al)	AlCl ₃
Potassium (K)	KCl
Magnesium (Mg)	MgCl ₂
Calcium (Ca)	CaCl ₂

- A) calcium and chlorine
 B) sodium and potassium
 C) potassium and aluminum
 D) aluminum and magnesium

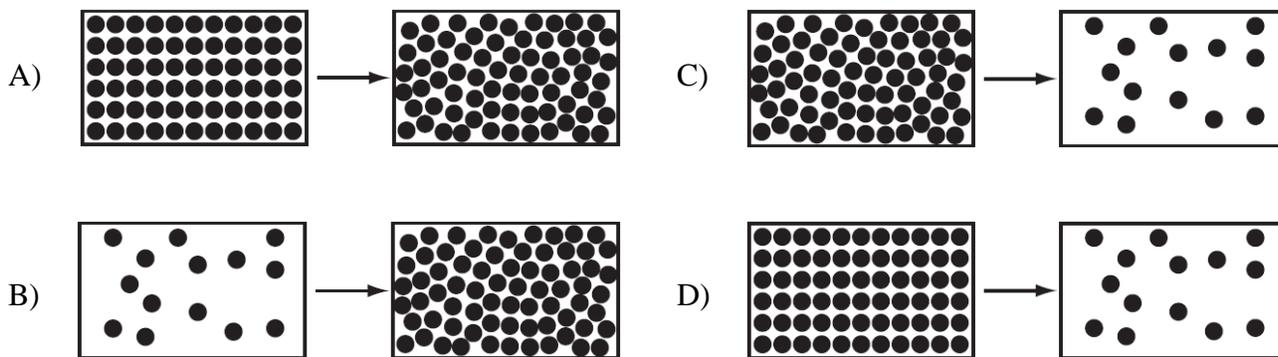
- (20) Which of the following is the farthest from Earth?

- A) Halley's comet
 B) Neptune
 C) the Andromeda galaxy
 D) the Sun

- (21) Which observation demonstrates that light waves travel much faster than sound waves?

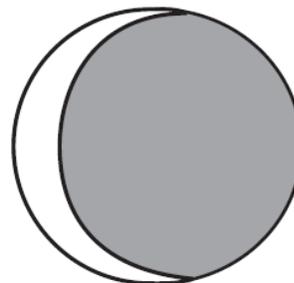
- A) An exploding airborne firework is seen before it is heard.
 B) Light from the Sun takes eight minutes to reach Earth.
 C) A returning echo is heard after a split-second delay.
 D) Thunder can be heard before lightning is seen.

- (22) Which diagram below represents the change of ice to water?

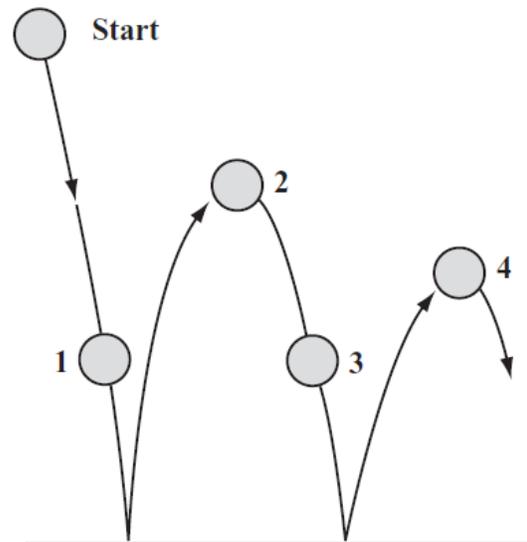


- (23) The diagram to the right shows the moon in one of its crescent phases. Which statement best explains the cause of the phases of the moon?

- A) The sun hides part of the surface of the moon.
 B) The sun, the moon, and Earth are in a straight line in space.
 C) Only part of the illuminated moon is visible from Earth.
 D) Only the light from the back side of the sun is reflected by the moon.



- (24) An apple was placed on the back seat of the car. Unfortunately, the car drove into an immovable barrier at a speed of 60 kilometers per hour (km/h). Which statement best describes the motion of the apple immediately after the car hit the barrier?
- A) The apple moved forward at 30 km/h. C) The apple moved forward at 60 km/h.
B) The apple moved backward at 30 km/h. D) The apple moved backward at 60 km/h.
- (25) Why do scientists study fossils?
- A) Scientists study fossils to learn how the planet was formed.
B) Scientists study fossils to study how organisms changed over time.
C) Scientists study fossils to observe how drought affected the landscape.
D) Scientists study fossils to understand how weathering affected rock layers.
- (26) Biologists conduct investigations to learn about living organisms. Which method helps reduce bias during an investigation?
- A) Biologist could develop a hypothesis after collecting data in the investigation.
B) Biologist could limit the amount of background research before the investigation.
C) Biologist could design an investigation with repeated trials during the investigation.
D) Biologist could obtain other opinions concerning what should happen during the investigation.
- (27) Students are studying the process of photosynthesis in plants. Which of the following is a product of photosynthesis?
- A) carbon dioxide C) nitrogen
B) sodium chloride D) sugar
- (28) A scientist is comparing two body cells of a multicellular organism. Which of the following is most likely identical?
- A) number of chromosomes C) number of mitochondria
B) shape of cell membranes D) shape of cell walls
- (29) The diagram to the right shows the path of a ball bouncing on the ground. Four locations in the path are identified with numbers. At which location does the ball have the least amount of kinetic energy?



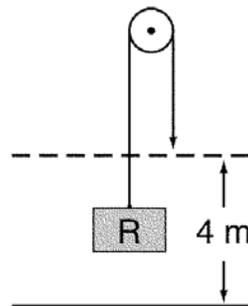
- A) location 1
B) location 2
C) location 3
D) location 4

- (30) A crop of corn plants is genetically modified so that the plants produce a natural pesticide. People are concerned that these corn plants might transfer modified genetic material to other plants. Which of the following is the best way to further modify the plants to prevent them from transferring their genetic materials to other plants?
- A) changing the plants so they do not harm insects
 - B) changing the plants so they do not make pollen
 - C) changing the plants so they cannot produce nutrients
 - D) changing the plants so they cannot be easily identified
- (31) Wolves kill many elk every year and often attack old, sick, and injured members of a herd. Which of the following best describes the role of the wolves in the wolf-elk relationship?
- A) competitor
 - B) parasite
 - C) host
 - D) predator
- (32) Earth's core is primarily composed of which of the following materials?
- A) basalt
 - B) magma
 - C) iron
 - D) quartz
- (33) Which of the following correctly orders part of a fish's respiratory system from the least complex to most complex?
- A) cells → gills → tissues
 - B) gills → tissues → cells
 - C) cells → tissues → gills
 - D) tissues → gills → cells
- (34) Engineers have recently developed alternative fuels such as ethanol to power vehicles. Ethanol is a fuel that is made from corn or other crops including wheat, barley, and potatoes. E85 is a mixture of 85% ethanol and 15% gasoline. The greatest environmental advantage to using E85 would be that
- A) It has gasoline mixed in it.
 - B) It is used to power vehicles.
 - C) It is made up mostly of renewable resources.
 - D) It is made from crops that require powerful fertilizers.
- (35) Which of these describes the lithosphere and the asthenosphere?
- A) Both are hot inner layers of earth capable of bending and moving.
 - B) Both are hard and rigid layers of earth close to the surface.
 - C) The lithosphere is rigid and immovable, and the asthenosphere is hot and flowing.
 - D) The asthenosphere is rigid and immovable, and the lithosphere is hot and flowing.
- (36) A plant with smooth seeds is crossed with a plant with wrinkled seeds. All the offspring have a smooth appearance. Which statement explains why this occurred?
- A) The offspring only received the genes from the parent with the genotype for smoothness.
 - B) The offspring only received the genes from the parent with the phenotype for smoothness.
 - C) The offspring received the genes from both parents, but the genotype for smoothness dominates.
 - D) The offspring received the genes from both parents, but the phenotype for smoothness dominates.
- (37) A lunar eclipse is not visible from Earth every month because the tilt of the moon's orbit is enough to place the moon out of Earth's shadow for most
- A) new-moon phases.
 - B) last-quarter phases.
 - C) first-quarter phases.
 - D) full-moon phases.

- (38) Which of the following planets has the shortest period of revolution?
 A) Earth
 B) Mars
 C) Venus
 D) Neptune
- (39) This year (2018) Elon Musk's company, Space Exploration Technologies Corporation (SpaceX) successfully launched its next generation rocket, Falcon Heavy, with a unique cargo. What was this cargo?
 A) One ton of soil from Space X's company headquarters in California.
 B) A life-size statue of current US president – Donald Trump.
 C) A one-ton replica of the US capitol building
 D) Mr. Musk's personal Tesla roadster.

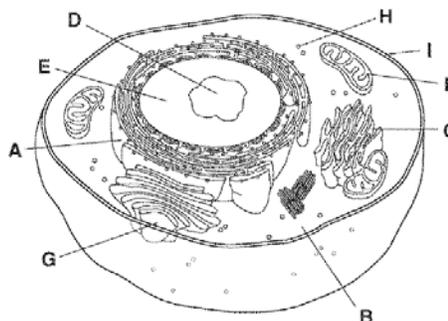
- (40) What are the primary pigment colors?
 A) yellow, blue, and green
 B) magenta, cyan, and yellow
 C) red, blue, and green
 D) white and black
- (41) In which of the following media will the speed of sound be greatest?
 A) steel
 B) vacuum
 C) water
 D) polystyrene

- (42) The fixed pulley, shown in the figure to the right, does which one of the following?



- A) doubles the force required to lift the block
 B) decrease the force required to lift the block
 C) decreases the force required and changes the direction of the force required
 D) makes the block harder to lift by changing the direction of the force needed to lift it
- (43) Which of the following correctly shows the formula for a hydrate?
 A) $\text{MgSO}_4(\text{H}_2\text{O})_7$
 B) $\text{MgOSO}_4 \cdot 7\text{H}_2\text{O}$
 C) H_2O
 D) H_2O_2
- (44) Which of the following is the best reason for using a scanning electron microscope?
 A) ability to observe live organisms
 B) ability to see movement within living cells
 C) ability to magnify objects that are larger than 0.2 micrometers
 D) ability to see three-dimensional images of the surfaces of objects

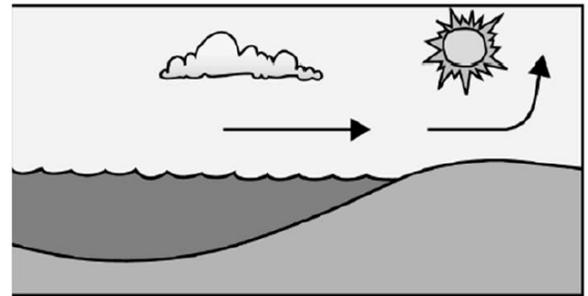
- (45) What is the cell structure in the figure to the right denoted with the letter **F**?
 A) Golgi apparatus
 B) rough endoplasmic reticulum
 C) mitochondrion
 D) ribosome



- (46) Interbreeding among members of a population results in
A) no changes in the relative frequencies of alleles in the gene pool.
B) changes in the relative frequencies of alleles in the gene pool.
C) an absence of genetic variation in the population.
D) different types of alleles in the gene pool.
- (47) Which human-heart chamber is the most muscular?
A) right atrium
B) right ventricle
C) left atrium
D) left ventricle
- (48) When all vegetation is removed from a site by human activity or by natural forces such as volcanic activity, which species are the first to colonize the site?
A) prokaryotic
B) climax
C) pioneer
D) deciduous
- (49) What is the chemical symbol for the element silver?
A) Au
B) Ag
C) S
D) Sr
- (50) Which of the following is not found in the nucleus?
A) mitochondria
B) RNA
C) DNA
D) enzymes
- (51) A car moving north with a speed of 80 feet per second slows down to 70 feet per second in 5 seconds. Which statement correctly describes the car's motion?
A) The car experienced a speed of 2 feet/second north.
B) The car experienced a velocity of 2 feet/second/second/south.
C) The car experienced an acceleration of 2 feet/second/second south.
D) The car experienced an acceleration of 2 feet/second/second north.
- (52) A scientist is studying a substance that is cycled through ecosystems. Which of the following substances might the scientist be studying?
A) soil
B) glucose
C) copper
D) nitrogen
- (53) While camping at Falcon Dam State Park, you come across organisms that are multicellular, have no chlorophyll, and absorb nutrients from a dead, decaying tree. What have you found?
A) Fungi
B) Protista
C) Plantae
D) Animalia
- (54) In the excretory system, urine leaves each kidney through a slender tube. What is this tube called?
A) urinary bladder
B) ureter
C) urethra
D) urea
- (55) According to Newton's second law of motion, how much net force would be needed to cause a 12 kg object to accelerate 3 meters/second/second?
A) 36 Newtons
B) 108 Newtons
C) 4.0 Newtons
D) 54 Newtons

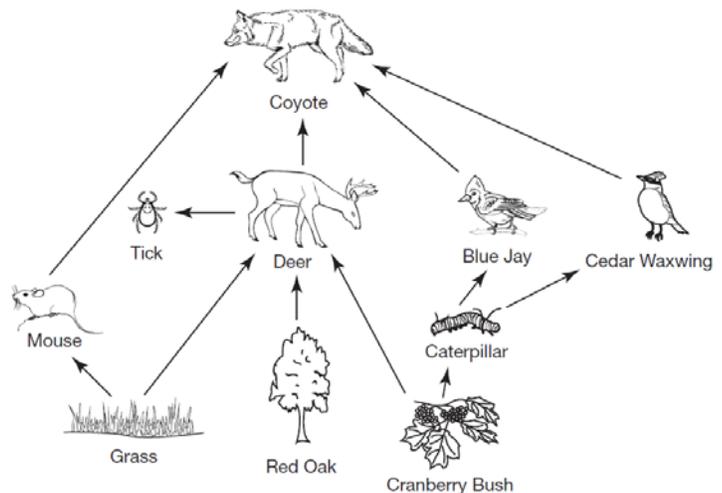
- (56) Which of the following is associated with Karst topography?
- A) fossiliferous sandstones C) hydrothermal activity
B) large granitic boulders D) sinkholes
- (57) What is the gradient, in feet per mile, of a stream slope whose highest elevation is 1600 feet to a point with an elevation of 400 feet over a distance of 5 miles?
- A) 240 feet/mile C) 250 feet/mile
B) $\frac{1}{4}$ foot/mile D) 25 feet/mile

- (58) The diagram to the right shows a sea breeze. A sea breeze blows from the sea toward the land. What is the role of the sun in creating a sea breeze?



- A) The sun warms the land faster than the sea, causing the air above the land to expand and rise.
- B) The sun warms the sea, creating waves that move the air above the sea surface toward the land.
- C) The sun warms the land, creating a condition of higher air pressure that pulls in the cooler sea air.
- D) The sun warms the sea faster than the land, causing the air above the sea to expand and spread out.
- (59) Which procedure best determines whether water temperature affects the time it will take a sugar cube to dissolve?
- A) Test three sugar cubes in one water temperature.
- B) Test three sugar cubes, one each in an acid, a base, and water.
- C) Test one crushed sugar cube and one whole sugar cube in water.
- D) Test three sugar cubes, one each in three different water temperatures.

- (60) Using the diagram to the right which food chain best shows the flow of matter in organisms in the food web?



- A) tick → mouse → red oak
- B) grass → deer → blue jay
- C) cranberry bush → deer → coyote
- D) blue jay → caterpillar → cedar waxwing