

**TMSCA MIDDLE SCHOOL
SCIENCE
STATE TEST ©
APRIL 1, 2023**

GENERAL DIRECTIONS

1. About this test:
 - A. You will be given 40 minutes to take this test.
 - B. There are 50 problems on this test.
2. All answers must be written on the answer sheet/Scantron form/Chatsworth card provided. If you are using an answer sheet be sure to use **BLOCK CAPITAL LETTERS**. Clean erasures are necessary for accurate grading.
3. If using a Scantron answer form, be sure to correctly denote the number of problems not attempted.
4. You may write anywhere on the test itself. You must write only answers on the answer sheet.
5. You may use additional scratch paper provided by the contest director.
6. All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
7. On the back of this page is a copy of the periodic table of the elements as well as a list of some potentially useful information in answering the questions.
8. A simple scientific calculator with the following keys is sufficient for the science contest: +, -, %, ^, log x, e^x, ln x, y^x, sin x, sin^{-x}, cos x, cos^{-x}, tan x, tan^{-x}, with scientific notation and degree/radian capability. The calculator must be silent, hand-held and battery operated. The calculator cannot be a computer or cannot have built-in or stored functionality that provides scientific information and cannot have communication capability. If the calculator has memory, it must be cleared. Each student may bring one spare calculator. **NO GRAPHING CALCULATORS ARE PERMITTED.**
9. All answers within $\pm 5\%$ will be considered correct.
10. All problems answered correctly are worth **FIVE** points. **TWO** points will be deducted for all problems answered incorrectly. No points will be added or subtracted for problems not answered.
11. In case of ties, percent accuracy will be used as a tie breaker.

Periodic Table of the Elements

1A 1																	2 18
1 H 1.01																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3B 3	4B 4	5B 5	6B 6	7B 7	8 8	9 9	10 10	1B 11	2B 12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.9	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (281)	111 Rg (281)	112 Cn (285)	113 Nh (286)	114 Fl (289)	115 Mc (289)	116 Lv (293)	117 Ts (293)	118 Og (294)

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

OTHER USEFUL INFORMATION

Acceleration of gravity at Earth's surface, $g = 9.81 \text{ m/s}^2$

Avogadro's Number, $N = 6.02 \times 10^{23}$ molecules/mole

Planck's constant, $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$

Planck's reduced constant, $\hbar = h/2\pi = 1.05 \times 10^{-34} \text{ J}\cdot\text{s}$

Standard temperature and pressure (STP) is 0°C and 1 atmosphere

Gram molecular volume at STP = 22.4 liters

Velocity of light, $c = 3.0 \times 10^8 \text{ m/sec}$

Absolute zero = $0 \text{ K} = -273.15^\circ\text{C}$

Gas constant, $R = 1.986 \text{ cal/K}\cdot\text{mole} = 0.082 \text{ liter}\cdot\text{atm/K}\cdot\text{mole}$

One Faraday = 96,500 coulombs ($9.65 \times 10^4 \text{ C}$)

Dulong and Petit's constant = $6.0 \text{ amu}\cdot\text{cal/gram}\cdot\text{K}$

Electron rest mass, $m_e = 9.11 \times 10^{-31} \text{ kg}$

Atomic mass unit, $m_u = 1.66 \times 10^{-27} \text{ kg}$

Boltzmann constant, $k_B = 1.38 \times 10^{-23} \text{ J/K}$

Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$

Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$

1 Atmosphere = $1.02 \times 10^5 \text{ N/m}^2 = 760 \text{ Torr} = 760 \text{ mmHg}$

1 Electron Volt = $1.6 \times 10^{-19} \text{ Joules}$

Charge of an electron = $-1.6 \times 10^{-19} \text{ coulombs (C)}$

1 horsepower (hp) = $746 \text{ W} = 550 \text{ ft}\cdot\text{lb/s}$

Neutron Mass = 1.008665 au

Proton Mass = 1.007277 au

1 au = 931.5 MeV

1 calorie = 4.184 Joules (J)

Specific heat of water = $4.18 \text{ J/g}\cdot^\circ\text{C}$

2022-2023 TMSCA Middle School Science Test - State

1. In lab, the students made a “home-made” hand warmer. To do this, they took some super absorbent polymer crystals and added them to some water in a plastic bag. Next, they added some calcium chloride and a little more water. After squishing it around, the students noticed immediately that the plastic bag with the substance began to warm up. What type of chemical reaction does this represent?

- A. endothermic B. exothermic C. both A and B D. not a chemical reaction

2. Nick’s teacher had a small cup of plain water. She added an indicator solution to the water which made it look green. She put a straw in the water and blew her breath into the water in the cup continuously until the water that looked green turned yellow.

What equation below best describes what happened in this demonstration?

- A. $H_2O + CO_3 \rightarrow H_2CO_3$
B. $CO_2 + H_2O \rightarrow H_2CO_3$
C. $CO + H_2O \rightarrow COH_2O$
D. $H_2O + N_3 \rightarrow H_2NO_3$

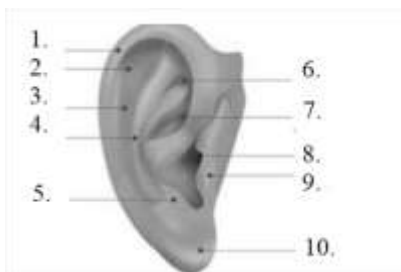


3. Which statement below about the results of the demonstration above is most likely true?

- A. The indicator solution turned yellow to show that the water was now basic.
B. When the teacher blew into the cup, she added acid from her saliva to the cup which caused a chemical reaction.
C. When the water in the cup turned yellow, a reaction occurred, and carbonic acid was formed.
D. The teacher’s breath contained Nitrogen which reacted to make the substance alkaline.

4. Christy’s friend got her ear pierced in the antitragus part of the ear and it got infected, so she had to get an antibiotic ointment for it. What part of the ear would she place the ointment? (see below)

- A. 1 B. 6 C. 5 D. 9



5. What is primary reason that bees “buzz”?

- A. to warn that they will sting
B. to attract other bees before attacking a predator
C. to remove pollen from the flower’s anthers
D. there is no purpose for the buzzing sound

6. Out of these, which is currently is the most active volcano in the United States?

- A. Kilauea B. Mt. Etna C. Mount Saint Helens D. Capulin

7. What is the only known planet in our solar system that is not visible to the naked eye?

- A. Mars B. Jupiter C. Saturn D. Neptune

8. The diagram to the right is one stage in the life cycle of what?

- A. plankton B. mussels C. fungus D. seaweed



9. The closest point that the moon is to the Earth is called what?

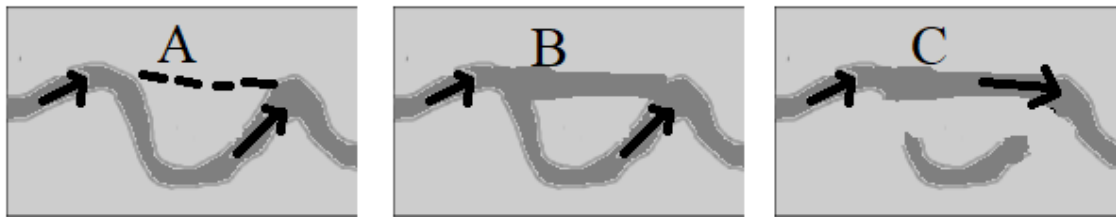
- A. aphelion B. perihelion C. apogee D. perigee

10. When studying arthropods, you might come across “metasoma” and “mesosoma”. What is the difference in meaning between these two terms?

- A. Metasoma is the front part and mesosoma is the back part.
- B. Mesosoma is the middle section and metasoma is the back section.
- C. These terms refer to the same part.
- D. Metasoma is the middle section and mesosoma is the front section.

11. When studying bees, the word phylogeny comes up for discussion. What does this word deal with?

- A. evolutionary development of a species
- B. diversification of a species
- C. history of the development of a species
- D. all the above

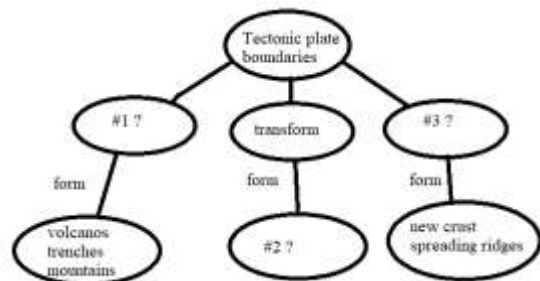


12. The series of diagrams above show the stages that occurred with a river. What landform was created in box C over time?

- A. an atoll
- B. an oxbow lake
- C. a tributary
- D. a watershed

13. In this concept map, what word would you place in the spot designated #3?

- A. earthquakes, linear valleys
- B. transform boundary
- C. convergent boundary
- D. divergent boundary



14. Janet lost her pet dog, Scruffy. She started yelling for Scruffy down the street as loud as she could yell. How many decibels could Janet’s scream register?

- A. 20
- B. 40
- C. 100
- D. 500

15. Which of the following is not a scalar quantity?

- A. length
- B. time
- C. vector
- D. mass

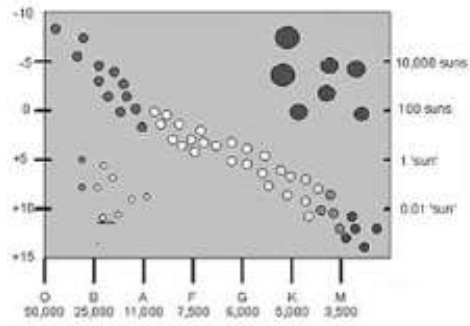
16. Biomass, such as the matter that comes from plants or from animals, is also known as what?

- A. abiotic factors
- B. organic matter
- C. sediments
- D. Both A and B

17. The weight of object is 75 N and the buoyant force is 50 N. What will the object do if it is placed in water?

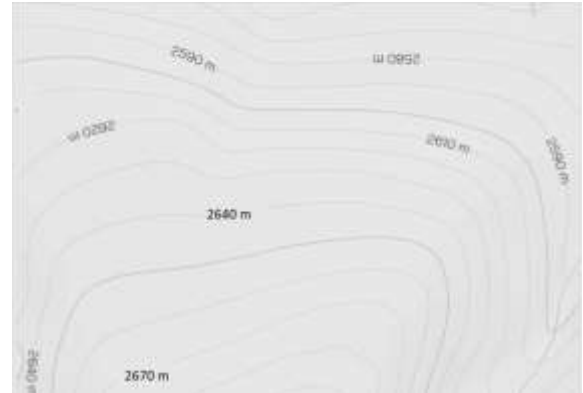
- A. float
- B. sink
- C. be suspended in the water
- D. sink and then float

18. The diagram to the right is called an HR diagram. It shows the relationship between absolute magnitude of stars and their spectral class.



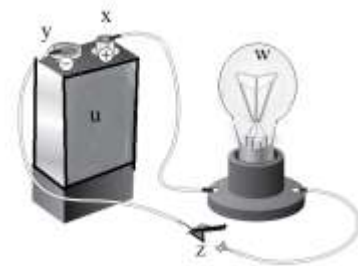
- What does HR stand for?
 A. Hershell-Rubin
 B. Halley - Rustin
 C. Hammond-Riley
 D. Hertzsprung-Russell

19. The distance between the lines on this topographical map stand for what?



- A. 5 m
 B. 10 m
 C. 20 m
 D. 30 m

20. What direction will the electricity flow when switch Z is closed?



- A. from X to W to Z to Y
 B. from Z to Y to X to W
 C. from Y to Z to W to X
 D. from Z to Y then to Z to W

21. reactants → products

In a chemical reaction, if it takes more energy for the reactants to break apart than the energy released for the products to form bonds, then the reaction is what?

- A. endothermic and the temperature increases
 B. exothermic and the temperature increases
 C. endothermic and the temperature decreases
 D. exothermic and the temperature decreases

22. What does the prefix “uni” mean?

- A. together B. single C. blue D. tall

23. Three people were caught and arrested for killing white-tailed deer without landowner’s permission. This would be an example of what type of crime?

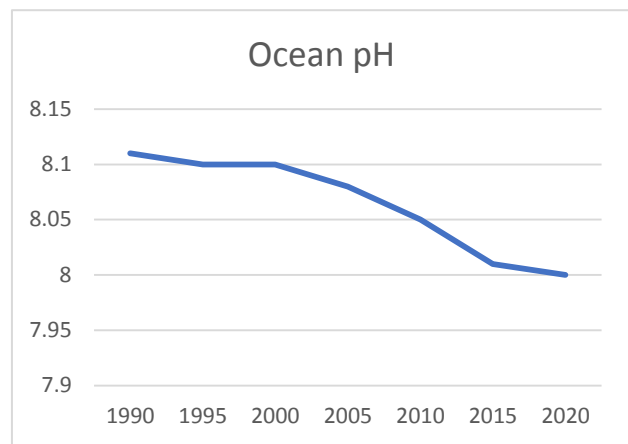
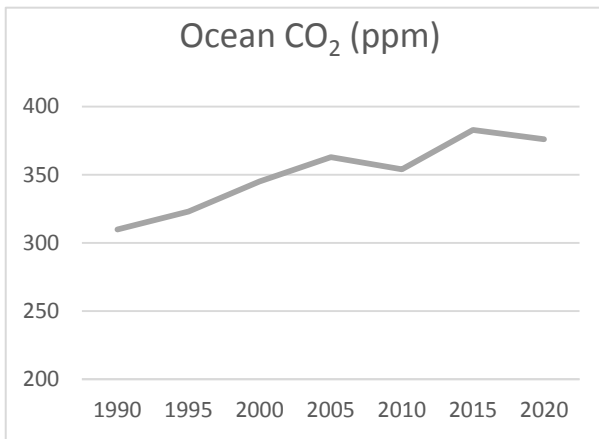
- A. poaching B. harvesting C. reaping D. vandalism

24. What is the most abundant cell in the human body?

- A. red blood cells B. nerve cells C. skin cells D. bone marrow

25. What is the SI unit of measurement of the magnitude of a magnetic field called?

- A. Elon (E) B. Tesla (T) C. Newton (N) D. Ohm (O)



26. The graphs above show the CO₂ content of the Ocean and the Ocean pH at a designated location from the years 1990 to 2020. From these graphs, what statement could be made based on this data?

- A. The ocean's CO₂ content and Ocean pH increased over this 30-year period.
- B. While the Ocean CO₂ content increased, the Ocean pH decreased slightly over the 30-year period.
- C. The Ocean CO₂ content follows the Ocean pH amount over time.
- D. The Ocean pH became more alkaline as the Ocean CO₂ content increased.

27. These clouds are composed of ice crystals.

They are high and wispy clouds. What type of clouds are they?

- A. cumulus B. cirrus C. stratus D. nimbus



28. The layers of Earth's atmosphere are separated according to what criteria?

- A. thermal characteristics, chemical composition, movement, and density
- B. altitude only
- C. air pressure, temperature, wind speed
- D. the color composition of particles found in the layers

29. The plant in the photo on the right has adaptations to help it survive.

What biome does it most likely live in?

- A. taiga B. desert C. tundra D. forest



30. Most mother bats give birth to only 1 pup each year. What is the most likely reason for this?

- A. Bat pups are born ready to fly so the mother can find food.
- B. The mothers die off after their pup is born.
- C. Bat size is the problem. Bat pups are born at up to 1/3 their mother's weight.
- D. There would not be enough food for more than 1 pup in the colony.

31. Bats belong to what Kingdom, Phylum, Class, and Order?

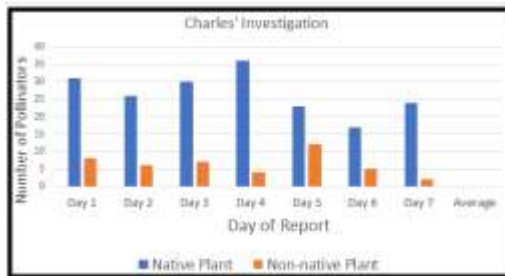
- A. Animalia, Chordata, Mammalia, Rodentia
- B. Animalia, Echinodermata, Rodentia, Chiroptera
- C. Animalia, Chordata, Mammalia, Chiroptera
- D. Animalia, Mammalia, Chordata, Rodentia

32. Charles noticed that his parents have native and non-native plants in the backyard. The non-native plant grows very well and produces an abundance of pink blossoms. The native plant also grows very well and produces an abundance of red blossoms. Charles investigated to see which of the plants attracted more pollinators. Each day for 1 week, he watched each of the plants and counted how many pollinators visited the flowers in a specific section of the plants for 1 hour each day. He recorded the information in a chart (as shown).

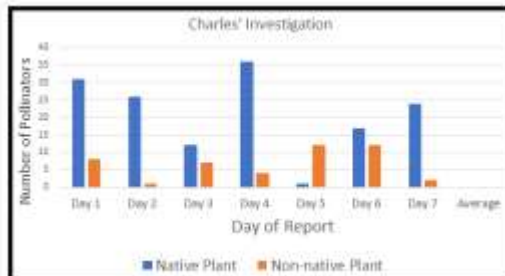
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Average
Native Plant	24	17	23	36	30	26	31	
Non-native Plant	2	5	12	4	7	6	8	

Which graph below would match the data from Charles' chart?

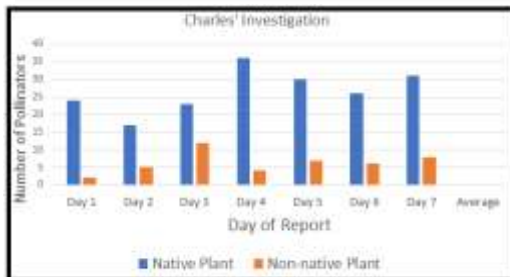
A.



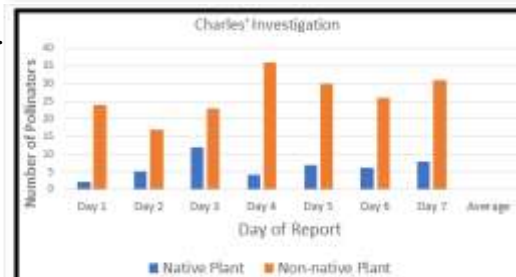
B.



C.



D.



33. What would the average be for both native and non-native plant pollinator visitors for the week? (rounded to nearest tenth)

- A. Native – 6.3 Non-native – 26.7
- B. Native – 26.3 Non-native – 7.6
- C. Native – 26.7 Non-native – 6.3
- D. Native – 27.6 Non-native – 3.6

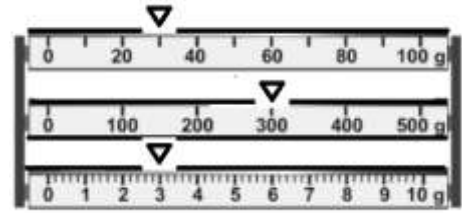
34. What conclusion could Charles make from investigation?

- A. Native plants attract about 5% more pollinators than non-native plants.
- B. Native plants attract fewer pollinators than non-native plants.
- C. Non-native plants do not attract as many pollinators as native plants.
- D. Non-native plants attract about 3 times more pollinators than native plants.

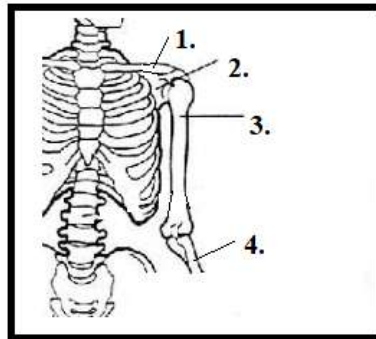
35. What is the independent variable in Charles' investigation?

- A. the number of pollinators that came
- B. whether the plants were native or non-native
- C. the number of blossoms on the plants
- D. the type of pollinators that visited the plant

36. What mass is indicated on this triple beam balance scale?
 A. 233 g
 B. 333 g
 C. 203003 g
 D. 328 g

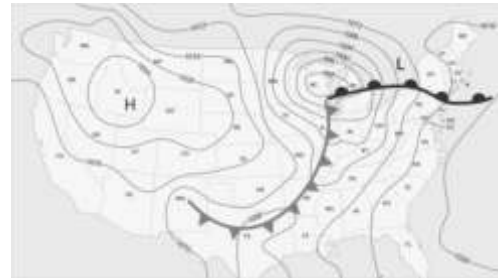


37. There are about how many different types of naturally occurring minerals on Earth?
 A. 1,000 B. 2,000 C. 30,000 D. 4,000



38. In the above diagram, what bone is labeled number 2?
 A. scapula B. humerus C. radius D. clavicle

39. What does the “L” mean on this weather map?
 A. land breeze
 B. lightning
 C. land spout
 D. low pressure



40. What is the name of the weather phenomenon involving plasma in which there is a blue or violet glow around a rodlike object usually during a thunderstorm before lightning strikes?
 A. St. Elmo’s fire B. X-factor C. fluor D. bioluminescence

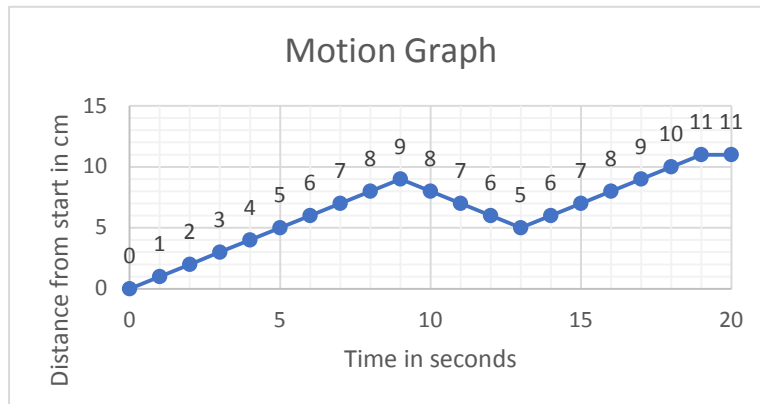
41. The highest point of a wave is called what?
 A. trough B. length C. crest D. hat

42. When studying about minerals, a scientist noticed that there were minerals growing within other minerals in one sample. What are these called?
 A. blebs B. dents C. splotches D. spurts

43. When there is an increase or decrease in wave frequency caused by motion of the source or by the motion of the observer, this is called what?
 A. dissociation B. refraction C. Coriolis Effect D. Doppler Effect

44. What organisms are seedless, are composed of vascular tissue, and includes the ferns?
 A. gymnosperm B. angiosperm C. bryophytes D. pteridophytes

Use the graph below to answer the questions. The object was moving in a straight line from the starting point.



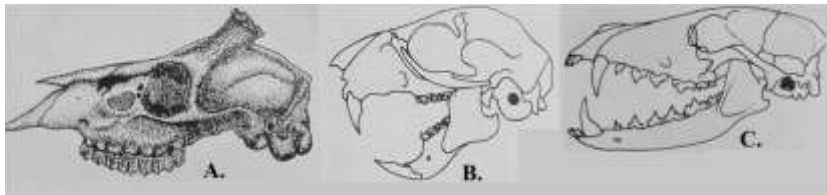
45. According to this graph, how fast was the object moving in the first 9 seconds?

- A. 1cm/sec B. 9 cm/sec C. 10 cm/sec D. 2 cm/sec

46. Between 19 and 20 seconds on this graph, what happened?

- A. the object lurched forward
 B. the object stopped moving
 C. the object rolled backwards
 D. there is no way to tell with this graph

47. Which of the following animal skulls is from a white-tailed deer?



- A. A B. B C. C D. none of these

48. Earth's geologic timeline is what?

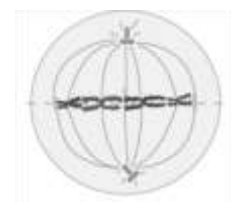
- A. evenly distributed between the different time periods
 B. based on episodic events
 C. 1,000-year increments
 D. based on predictable events

49. Diamond – Graphite – Charcoal These substances have a commonality. What is it?

- A. They are not related in any way.
 B. They are all composed of exactly two elements.
 C. They are allotropes of Carbon.
 D. They have the same number of letters.

50. What phase of mitosis is this diagram of a cell displaying?

- A. Anaphase B. Celophase C. Mesophase D. Metaphase



2022 - 2023 TMSCA Middle School Science State Test - Key

1. B	18. D	35. B
2. B	19. B	36. B
3. C	20. C	37. D
4. C	21. C	38. A
5. C	22. B	39. D
6. A	23. A	40. A
7. D	24. A	41. C
8. C	25. B	42. A
9. D	26. B	43. D
10. B	27. B	44. D
11. D	28. A	45. A
12. B	29. B	46. B
13. D	30. C	47. A
14. C	31. C	48. B
15. C	32. C	49. C
16. B	33. C	50. D
17. B	34. C	