T M S C A   M I D D L E   S C H O O L

S C I E N C E

T E S T # 9 ©

J A N U A R Y   2 8 ,   2 0 2 3

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: $+$, $-$, %, $\wedge$, log x, e^x, lnx, 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 ± 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.

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Periodic Table of the Elements

1A 1																	8A 18
1 H 1.01	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	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	—8B— 9	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, $g = 9.81$ m/s^2

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

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

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

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

Gram molecular volume at STP = 22.4 liters

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

Absolute zero= 0 K = -273.15°C

Gas constant, $R = 1.986$ col/K•mole = 0.082 liter•otm/K•mole

One Faraday= 96,500 coulombs (9.65×10^4 C)

Dulong and Petit's constant= 6.0 amu•col/gram•K

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

Atomic mass unit, $m_u = 1.66 \times 10^{-21}$ kg

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

Permittivity of free space $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N•m^2

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

1 Atmosphere= 1.02×10^5 N/m^2 = 760 Torr = 760 mmHg

1 Electron Volt - 1.6×10^{-19} Joules

Charge of an electron = -1.6×10^{-19} coulombs (C)

1 horsepower (hp) = 746 W = 550 ft•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 J/g• °C

1. Spiders are commonly thought to be scary and dangerous to most people. Markeshia conducted a survey of 1,000 random people to find out their attitudes about spiders. The results of the survey showed that out of the people surveyed, 658 had a negative attitude toward spiders, 139 were indifferent, and the rest had a positive attitude. What percentage of the survey had a positive attitude toward spiders?
A. 10.3%   B. 13.9%   C. 20.3%   D. 65.8%

2. After Markeshia conducted her spider attitude survey, she decided to go through articles available on the internet about spiders and see if there were positive or negative connotations in the articles. She went through 300 articles and found that about 53% of the articles had a negative spin on spiders being "scary" or "dangerous". How many articles had a positive spin on spiders?
A. 141   B. 159   C. 47   D. none of these

3. What are the benefits of spiders in an ecosystem?
A. being a producer for the food chain
B. becoming food for other animals
C. keeping insect populations in check
D. Both B and C
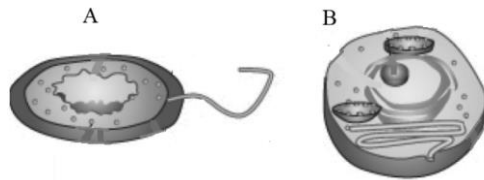
4. Looking at these diagrams of cells, what statement correctly identifies a difference?
A. Cell A has a nucleus and Cell B does not.
B. Cell A has a cell membrane and Cell B does not.
C. Cell A has a flagellum and Cell B does not.
D. Cell A has endoplasmic reticulum and Cell B does not.

5. The "power plants" of a eukaryotic cell are called what?
A. endoplasmic reticulum   B. mitochondria   C. ribosomes   D. lysosomes

6. Which of the following is an indicator species for a wetland ecosystem?
A. amphibians   B. macroinvertebrates   C. mosquitoes   D. Both A and B

7. Out of the following, which would be classified as a vegetable?
A. cucumber   B. apple   C. tomato   D. asparagus

8. If a storm is given the name "typhoon", where did it originate?
A. Northern Atlantic   B. Indian Ocean   C. Western Pacific   D. Both A and B

9. Which of the following planets has a diameter smaller than Earth?
A. Saturn   B. Jupiter   C. Uranus   D. Venus

10. Bryan wanted to study the native bees that visit his sunflowers for a period of a week over a 5-year time span. He observed the sunflowers for 2 hours each day for one week of the year and recorded his data in this chart.

2015	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
	30	25	28	27	35	33	36	
2016	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
	27	22	20	19	20	25	20	
2017	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
	15	17	12	44	13	18	12	
2018	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
	12	14	17	18	`3	17	13	
2019	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
	4	3	8	2	9	10	2	

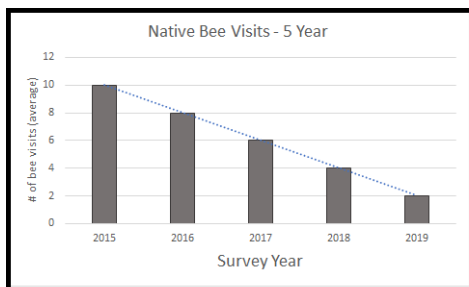Bryan noticed an "outlier" in his data. Where is this outlier?
A. Year 2015 on Friday
B. Year 2016 on Monday
C. Year 2017 on Thursday
D. There are no outliers.

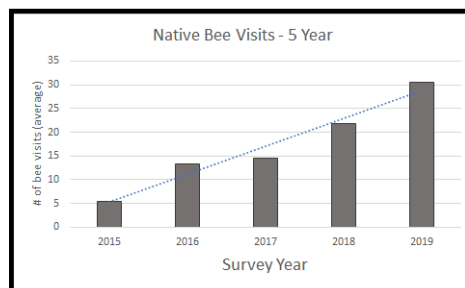11. What is the difference between the average number of bee visits in 2015 than in 2019? (round to nearest tenth)
A. 30.6   B. 5.4   C. 25.2   D. 21.8

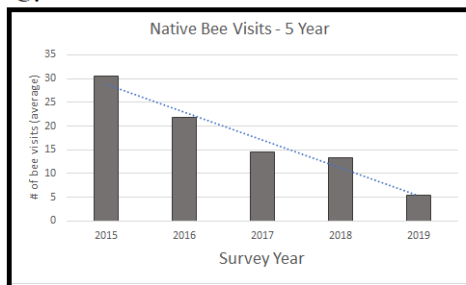12. Which graph below would best represent this data correctly (excluding the outlier)?
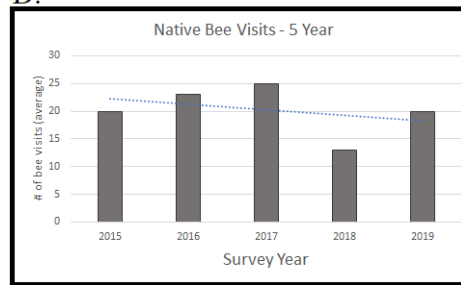
A.

B.

C.

D.

13. What conclusion can Bryan make about his observations?
A. The number of native bee visits over the last five years has steadily increased.
B. The number of native bee visits to the sunflowers depends on the temperature.
C. 2019 was an exceptional year for bees in backyard gardens.
D. The number of native bee visits over the last five years has steadily declined.

14. Baking a cake is what type of change?
A. physical
B. chemical
C. both physical and chemical
D. neither physical or chemical

15. What makes up blood?
A. plasma   B. red and white cells   C. platelets   D. all of these
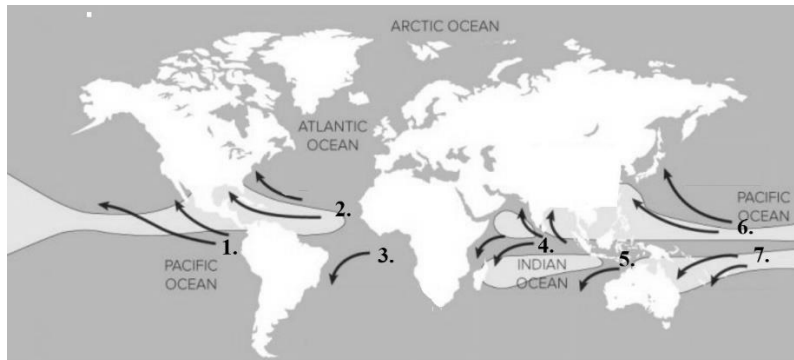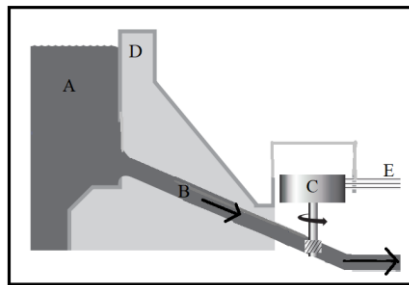

16. Fiona was considered a "hurricane". Where did it originate (use the above map)?
A. 1   B. 2   C. 3   D. 4

17. What day in the Northern Hemisphere has the fewest hours of daylight?
A. summer solstice   B. winter solstice   C. vernal equinox   D. autumnal equinox

18. The diagram above shows a hydroelectric dam. What is the name of the structure at location C?
A. spillway   B. generator   C. dam wall   D. reservoir

19. Work done per unit of time is called what?
A. wave   B. power   C. force   D. mass

20. The mass of a golf ball is 46 g. The mass of a ping pong ball is 2 g. If they both have the same volume of 40.68 cm^3, which of them has a density of about 1.13 g/cm^3?
A. the ping pong ball
B. the golf ball
C. both
D. There is no way to tell with the information given.

21. Josephine finished running 5 miles. She added a hydration/electrolyte packet to her water bottle. She shook it and the packet dissolved.

What is true about the substance in the hydration/electrolyte packet?

A. The substance in the packet is insoluble in water.
B. The water and the substance in the packet are both solvents.
C. The substance in the packet is soluble in water.
D. The water and the substance in the packet are both solutes.

22. By using displacement, approximately what is the volume of this irregular shaped object that was placed in the graduated cylinder?
(units shown are in milliliters)

A. 10 cm^3
B. 90 mL
C. 5 mL
D. Both A and C

Before........ After
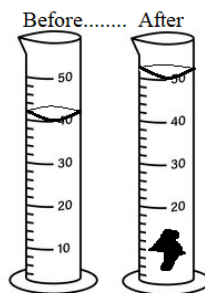
23. The flow of thermal energy through physical contact is called what?
A. heat convection   B. heat conduction   C. heat conversion   D. heat shear

24. What weather phenomenon involves a haboob?
A. windstorm   B. flood   C. hailstorm   D. blizzard

25. The ocean is a "carbon sink". What does this mean?
A. It takes carbon out of the rocks in the ocean bottom.
B. It adds carbon to the nutrients of the ocean floor.
C. It removes CO_2 from the atmosphere.
D. It adds CO_2 to the atmosphere.

26. What type of catastrophic events can happen in Texas?
A. hurricanes   B. tornados   C. drought   D. all of these

27. Almost all "weather" happens in what layer of Earth's atmosphere?
A. stratosphere   B. thermosphere   C. troposphere   D. mesosphere

28. Which statement below about tardigrades is not true?
A. Tardigrades reproduce only asexually.
B. They can go without food or water for about 30 years.
C. They use cryptobiosis to survive in dry environments.
D. They are mostly found in freshwater mosses and lichens.

29. A state of inactivity that is triggered by adverse environmental conditions is called what?
A. diapause   B. desiccation   C. cryptobiosis   D. symbiosis

30. This plant, *Opuntia tunicata,* has special adaptations that allow it to survive in a specific climate. Which biome below would be the best for this plant?
A. grassland
B. desert
C. tundra
D. taiga

31. Cleo's class did an activity in class in which they tested the effects of some substances on feathers. They legally obtained some bird feathers, dipped them in the substances, and then recorded what they observed. They noticed that when they dipped a feather in oil, the feather matted together and separated. What unit of study would they most likely be studying to conduct this activity?
A. Geology   B. Apiology   C. Heliology   D. Ecology

32. Solar winds can cause disturbances on Earth to what?
A. satellites, spacecraft, and the Earth's electric-power grid
B. ocean waves
C. earthquakes, tsunamis, hurricanes, volcanos
D. the jet stream

33. Cnidarians are interesting invertebrates with which of the following?
A. bilateral symmetry
B. two hearts and one lung
C. venomous fangs
D. radial symmetry

34. Kidneys, ureters, bladder, and the urethra all make up what body system?
A. renal   B. urinary   C. endocrine   D. Both A and B

35. Which of the following is a type of white blood cell in the human body?
A. erythrocytes   B. lymphocyte   C. hepatocyte   D. endothelial

36. White icebergs are composed of what?
A. frozen seawater
B. frozen freshwater from snow with trapped air bubbles
C. a combination of salt water and freshwater
D. alternating layers of snow and seawater

37. Cetaceans have a different method of locomotion than fish by moving their flukes how?
A. horizontally   B. vertically   C. side to side   D. both A and C

38. A property of minerals that refers to the ability to transmit light is called what?
A. ductility   B. malleability   C. diaphaneity   D. streak

39. What constellation can be seen year-round in Texas (on a clear night)?
A. Ursa Minor   B. Orion   C. Leo   D. Scorpius

40. What animal below is most likely a homeothermic animal?
A. snake   B. frog   C. field mouse   D. salamander

41. The teacher was conducting a demonstration in which he mixed two chemicals together. Immediately, bubbles formed in the mixture. What type of change took place?
A. a physical change
B. a chemical change
C. a reactant change
D. a solvent change

42. The graph below shows the distance a toy car moved along a straight line over 20 seconds.

Motion Graph
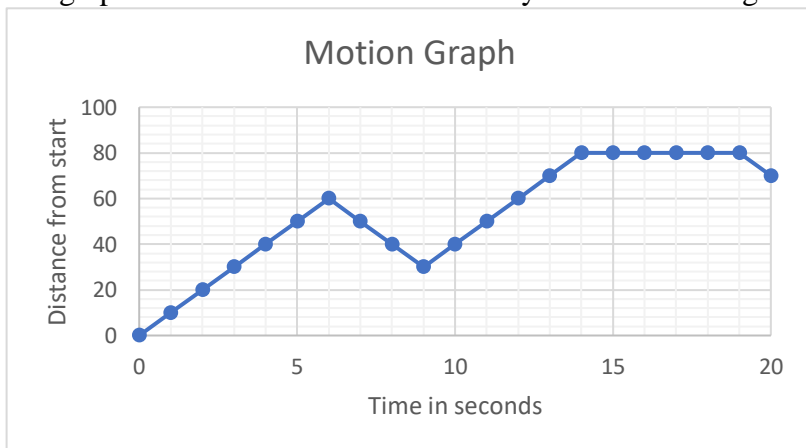
According to this graph, which description below is correct?
A. The toy car started moving and then stopped for 10 seconds before moving on.
B. The toy car gradually moved forward for 6 seconds, then moved in reverse for 3 seconds before continuing forward at a steady rate until stopping and then moving in reverse for 1 second.
C. The toy car gradually moved forward for 6 seconds, stopped for 3 seconds before moving forward.
D. The toy car climbed uphill for 6 seconds, went downhill, then climbed again to the top of a hill before rolling all the way down the hill.

43. What happened between the 14 and 19 seconds on the graph?
A. The toy car went in reverse.
B. The toy car stopped moving.
C. The toy car flipped upside down.
D. The toy car sped up very fast.

44. The measure of the number of objects or particles used in chemistry is called what?
A. farad   B. half-life   C. mole   D. ohm

45. Animals that walk on their toes leave footprints that are called "digitgrade". What are the footprints called of animals that walk on the flat of their feet like humans do?
A. palmigrade   B. plantigrade   C. unguligrade   D. phalange

46. Aaron has a black cat named Beetle. He took Beetle to the vet and got all the necessary health vaccines and vet recommended necessities. One day, Aaron's black cat went missing for about a month. After a long search, he found a black cat that looked just like his cat but wasn't completely sure if the cat found was his cat. What would be the best method for Aaron to be sure that the cat was his?
A. He could call his cat's name to the cat and watch to see if the cat would come to him because all cats will come to their name being called.
B. He could check the weight of the cat and compare it to the weight of the cat he found.
C. Cat's have a distinctive nose print that is like human fingerprints. He could check the nose print of his cat (if the vet made one) to the nose print of the cat he found.
D. There is no possible way to tell them apart!

47. The number of protons that are found in the nucleus of the atom is called what?
A. atomic number   B. atomic weight   C. neutron number   D. Both B and C

48. What happens if you change the direction of the flow of current through an electromagnet?
A. nothing changes
B. the poles will reverse
C. the magnetic ability will be lost
D. the electromagnet will only pick up certain items

49. A free-falling object only under gravity's pull has a downward acceleration of what on Earth?
A. 9.8 m/s^3 B. $10 \times 8 \text{ cm/s}^2$ C. 9.8 m/s D. 9.8 m/s^2

50. What is a pre-stellar object that radiates infrared radiation, but is not hot enough to begin nuclear fusion?
A. Neutron star   B. Black hole   C. Protostar   D. Red dwarf

2022 - 2023 TMSCA Middle School Science #9 Test - Key

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