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

S C I E N C E

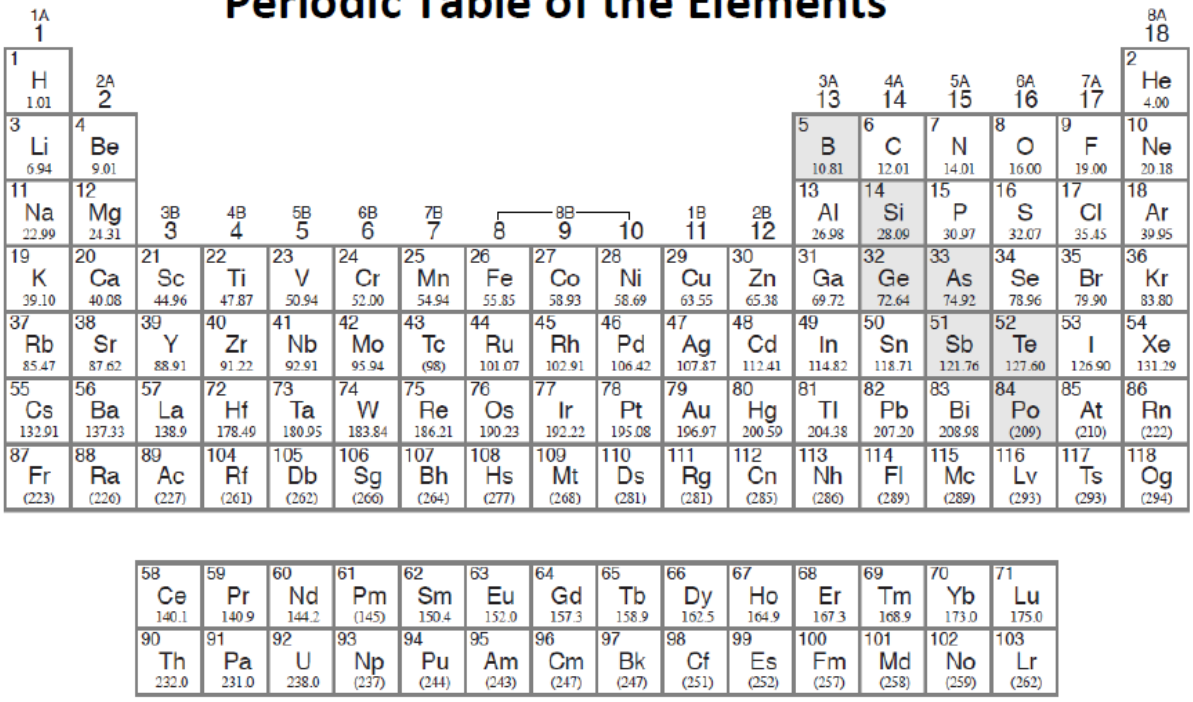
T E S T # 8 ©

J A N U A R Y 2 1 , 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: +, -, %, ^, 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.

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	8B 8	8B 9	8B 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)

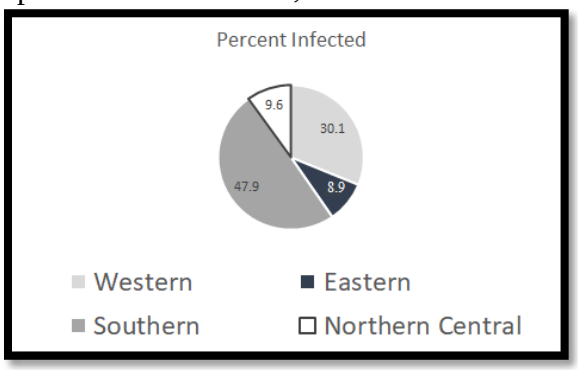
58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 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 x 10^{23} molecules/mole
Planck's constant, h = 6.63 x 10^{-34} J•s
Planck's reduced constant, $\hbar = h/2\pi$ = 1.05 X 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 x 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 x 10^4 C)
Dulong and Petit's constant= 6.0 amu•col/gram•K
Electron rest mass, m_e = 9.11 x 10^{-31} kg
Atomic mass unit, m_u = 1.66 x 10^{-21} kg
Boltzmann constant, k_B = 1.38 x 10^{-23} J/K
Permittivity of free space ε_0 = 8.85 x 10^{-12} $C^2/N•m^2$
Permeability of free space $\mu_0 = 4\pi$ x 10^{-7} T •m/A
1 Atmosphere= 1.02 x 10^5 N/m^2 = 760 Torr = 760 mmHg
1 Electron Volt - 1.6 x 10^{-19} Joules
Charge of an electron = -1.6 x 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

2022-2023 TMSCA Middle School Science Test - #8

1. Researchers for Monarch butterflies are concerned about the parasitic infection of Monarch butterflies by Ophryocystis elektroscirrha (OE for short). The parasite causes problems which lead to butterflies that cannot fly as well, don't live as long, and sometimes get stuck in their chrysalis when emerging. After using citizen scientists to help with data collection, the researchers found the following results shown in the graph.



If 1,000 butterflies were tested, how many in the Southern region were infected?

A. 301
B. 9
C. 89
D. 479

2. What would be a reasonable explanation for the differences in percentage of infections?

A. The amount of daylight in the Eastern region is longer than the others.
B. The climate of the southern region might allow for more OE to survive.
C. The southern and north central region has too many thunderstorms.
D. The north central region people take better care of the butterflies than the other regions.

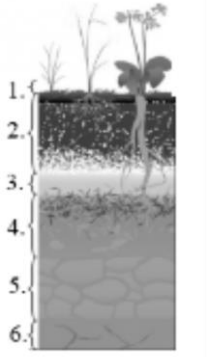
3. A biologist was researching how spiders spin their webs. This biologist would be a specialist in spiders and could also be called what?

A. ornithologist B. arachnologist C. ichthyologist D. piscivores

4. Cindy was writing an article describing the parts of a cell. She put titles on each section. One section was titled "Protein Factories". What part of the cell was this section about?

A. chloroplasts B. ribosomes C. lysosomes D. Golgi apparatus

5. In the soil profile diagram to the right, what layer is called "Horizon A" and is made up of humus?



A. 1
B. 2
C. 3
D. 4

6. The entomologist was studying an ant and pointed out that the mesosoma was extremely dark colored. What part of the ant was the scientist discussing?

A. the head B. the thorax C. the abdomen D. the antenna

7. Ants have an advanced level of organization with one female producing all offspring for the colony. This structure is called what?

A. eusocial B. precocial C. solitary D. social

8. According to the definition of a fruit, which of the following would be classified as a fruit?
A. cucumber B. carrot C. asparagus D. onion

9. What is the term for organisms that help to reflect the health of the environment and can help to determine the state of a particular ecosystem by monitoring them?
A. umbrella species B. indicator species C. keystone species D. dark species

10. Most average hurricanes move from what direction to what direction because of the tropical trade winds?
A. north to south B. west to east C. south to west D. east to west

11. Mars has a red colored surface because of why?
A. Mars surface is not actually red, it just appears that way from space.
B. The soil on Mars contains organic materials with a lot of Bromine.
C. The angle and distance of light from the sun reflects off the surface in a way that glows red.
D. Iron minerals in Martian soil oxidize and form rust making it look red.

12. What most likely formed this natural hole in this rock mountain?
A. dynamite
B. wind and water erosion over time
C. salt from the seawater in the air
D. animals digging over many years

13. The massive supercontinent that existed around 200 to 300 million years ago was called what?
A. Tethys B. Pangaea C. Gondwana D. Africana

14. Which of these asteroids would have the most gravitational pull with the sun?

Asteroid name	Mass	Distance from sun
AB1	6.6×10^{15}	2.2 AU
CD4	1.2×10^{15}	2.2 AU
FE5	2.4×10^{15}	2.2 AU
XR3	2.2×10^{15}	2.2 AU

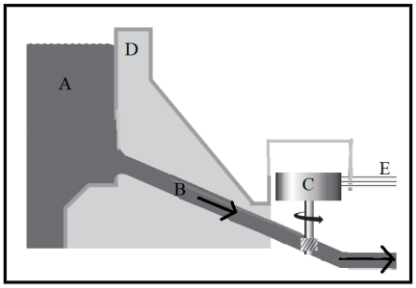
A. ABI B. CD4 C. FE5 D. XR3

15. Which of the following planets has less mass than Earth?
A. Saturn B. Mars C. Neptune D. Uranus

16. Comets and asteroids both do what?
A. give off light of their own
B. have a strong magnetic field
C. support extreme life forms
D. orbit the sun

17. What month is Earth the farthest from the sun?
A. December B. January C. March D. July

18. Jamie was visiting a cousin on the summer solstice. While at this city on that day, there was no sunset at all. What city below was Jamie visiting?
A. Svalbard, Norway B. Juneau, Alaska C. Denver, Colorado D. Sydney, Australia



19. In the above diagram, which energy transformations below shows kinetic energy to mechanical energy to electrical energy?
A. Location A to B to C
B. Location B to C to D
C. Location B to C to E
D. Location C to E to A

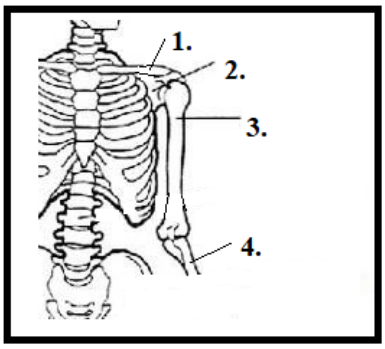
20. If a glass jar with a metal lid was hard to open, Jenny's grandmother said to hold it under a stream of hot running water and then it will loosen and open. Scientifically, why would this work?
A. When the metal in the lid is warmed, the molecules will contract and cause the lid to move.
B. When the metal in the lid is warmed, the molecules will move faster and spread which will loosen the lid.
C. The warm water will cause the glass in the jar to contract and then the lid will loosen.
D. It will not work. She should use cold water.

21. How do you tell the difference between a microwave and a gamma wave?
A. the smell of the reaction
B. the mass of each
C. the volume of the amplitude
D. the length of the wavelength

22. Force times distance is equal to what?
A. wave B. power C. work D. mass

23. Would your "weight" be more or less standing on the North Pole than at the equator on Earth?
A. Your weight would be exactly the same in both places.
B. Your weight would be slightly more at the North Pole than the equator.
C. Your weight would be slightly less at the North Pole than the equator.
D. There is no way to tell if it would be more or less without trying it out.

24. What animal below is most likely a poikilothermic animal?
A. dog B. lizard C. bird D. dolphin



25. In the above diagram, what bone is labeled number 3?
A. tibia B. humerus C. radius D. ulna

26. Which system of the body mainly defends against pathogens that may cause harm?
A. nervous B. respiratory C. endocrine D. immune

27. The teacher was conducting a demonstration in which she mixed two chemicals together. As soon as the chemicals were mixed, a solid white substance formed in the mixture. What is the white substance called?
A. a precipitate B. a rust C. a reactant D. a solvent

28. Animals that walk on the flat of their feet leave footprints that are called "plantigrade". What are the footprints called of animals that walk on their toes?
A. digitigrade B. palmigrade C. phalange D. carpal

29. Which of the following statements describes an object with kinetic energy?
A. a cat sitting on a windowsill of a house
B. a marble rolling down a ramp
C. a book sitting on a shelf
D. a cell phone sitting on the table

30. On average, about how far is the moon from the Earth?
A. 238,855 miles
B. 384,400 kilometers
C. about 30 earths, end to end
D. all the above are correct

31. Which of the following "fruit" types is called a pome?

32. A squirrel was seen in an oak tree. The squirrel was unusually all black in color. What is this condition called?

A. leucism B. melanism C. albinism D. xanthochromism

33. During a lab, students were trying to identify 4 unknown white substances, including sugar, corn starch, baking soda, and baking powder. Here are the results of their tests:

Substance	Reacts with water added	Reacts with vinegar added	Turned dark with iodine
A	no	yes	no
B	no	no	yes
C	no	no	no
D	yes	yes	no

According to these results, which table below is most likely correct?

A.

Letter	Name
A	Baking powder
B	Baking soda
C	Corn starch
D	Sugar

B.

Letter	Name
A	Corn starch
B	Baking soda
C	Baking powder
D	Sugar

C.

Letter	Name
A	Baking soda
B	Corn starch
C	Sugar
D	Baking powder

D.

Letter	Name
A	Sugar
B	Baking soda
C	Baking powder
D	Corn starch

34. Every cell in the human body contains DNA. What is wrong with this statement?

A. Human cells do not contain DNA at all.
B. Mature red blood cells do not contain DNA.
C. DNA is only found in skin cells in humans.
D. There is nothing wrong with this statement. It is correct.

35. Snell's Law deals with what?

A. the way light waves travel through gas
B. the way snails move when travelling across a wet surface
C. relationship of angles of incidence and refraction when light passes through media boundaries
D. the properties of radiation particles travelling through empty space

36. If Simon shines a red light on a surface, the surface looks like it is black. If he shines a blue light on the surface, it also looks like it is black. If Simon shines a green light on the surface, the surface looks green. What does this say about how the surface reflects light?

A. It only reflects green light.
B. It only absorbs green light.
C. It only reflects blue light, but not green light.
D. It only reflects red light, but not green light.

37. Sandy's class was extracting DNA from strawberries. Here was the procedure they followed:

1. Smash three strawberries in a resealable plastic bag for 2 minutes.
2. Add three tablespoons of the extraction liquid *composed of a half tsp. salt, 1/3 cup of water, and 1 tablespoon of dishwashing detergent.
3. Push the extra air out of the bag and squish the mixture together (trying not to make bubbles) for one more minute.
4. Filter the substance in the bag through a cheesecloth filter.
5. Put the filtered substance into a container and slowly add ½ cup of chilled rubbing alcohol.
6. Watch for the DNA to appear between the layers of alcohol and strawberry liquid mixture.

One item used in the extraction was dishwashing detergent. What was the purpose of the dishwashing detergent?

A. The dishwashing detergent was only used to clean the test tubes used in the experiment.
B. The dishwashing detergent was added to the mashed strawberries to lyse the cells or break them open so that the DNA could be accessed.
C. The dishwashing detergent was used to cause the strands of DNA to cling together so that they will become visible to the naked eye.
D. The dishwashing detergent was used to wash away the excess materials in the strawberries, such as bacteria, fungus, etc. to keep the sample clean.

38. What was the purpose of the salt in the extraction liquid?

A. To destroy the cell membranes of the cells.
B. To break up the protein chains that bind around the nucleic acids.
C. To cause a chemical reaction with the strawberry DNA.
D. To make filtering the extra stuff in the mixture easier and more effective.

39. What was the purpose of using the chilled rubbing alcohol in this investigation?

A. To destroy the cell membranes of the cells.
B. To cause the DNA to precipitate so that it can clump together and become visible.
C. To cause a chemical reaction with the strawberry DNA.
D. To disinfect the materials used in the investigation so that there is no bacteria.

40. Why are strawberries commonly used in DNA extraction lab activities?

A. Strawberries have achenes which contain seeds that break apart easier than other types of fruits and vegetables.
B. Strawberries are most everybody's favorite fruit, so they are easy to find.
C. Strawberries are the least expensive to use in DNA extraction lab activities.
D. Strawberries are octoploids and have 8 copies of each type of chromosomes which provides more to work with.

41. Which of the following elements belongs with the halogens?

A. Fluorine B. Neon C. Iodine D. Both A and C

42. Which element(s) listed here are named after countries?

A. Po B. Eu C. Cf D. all of these

43. A substance that is composed of only a single type of atom is called what?

A. mixture B. chemical element C. a nuclei D. electron

44. The particle that holds a positive electrical charge in an atom is called what?
A. neutron B. proton C. electron D. positron

45. What term is given to the species that is vitally important to an ecosystem so much so that if it was no longer in that system, the ecosystem would suffer and change?
A. invasive species B. ecological species C. distributive species D. keystone species

46. When coral organisms stay too warm for an extended amount of time, the heat wave can cause them to eject the algae that live inside them. Which of the following is a result of this happening?
A. The coral flourishes and grows new branches.
B. The coral goes through the next stage in their life cycle.
C. The algae die immediately.
D. The coral may turn bone-white and die.

47. Which one of the following is not a correct unit of density?
A. kg per liter B. g per cm^3 C. g per mL D. kg per meter

48. The Greek word "atomos" that was the basis for the word "atom" means what?
A. tiny B. uncuttable C. micro D. strong

49. The particle that holds a negative electrical charge in an atom is called what?
A. neutron B. proton C. electron D. negatron

50. These formations happen when cold air sinks down in contrast to the warm convectional current puffs usually found at the base of a cloud. What are these patterns called?
A. shelf clouds
B. wall clouds
C. cirrus formations
D. mammatus

2022 - 2023 TMSCA Middle School Science #8 Test - Key

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