

# TMSCA MIDDLE SCHOOL SCIENCE SUN RIDGE MEET © 2019

## 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 formulas is sufficient for the science contest: +, -, %, ^, log x, e<sup>x</sup>, ln x, y<sup>x</sup>, sin x, sin<sup>-x</sup>, cos x, cos<sup>-x</sup>, tan x, tan<sup>-x</sup>, 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 1 H 1.01	2A 2 4 He 4.00											3A 13 5 B 10.81	4A 14 6 C 12.01	5A 15 7 N 14.01	6A 16 8 O 16.00	7A 17 9 F 19.00	8A 18 10 Ne 20.18
3 Li 6.94	4 Be 9.01											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
11 Na 22.99	12 Mg 24.31	3B 3 21 Sc 44.96	4B 4 22 Ti 47.87	5B 5 23 V 50.94	6B 6 24 Cr 52.00	7B 7 25 Mn 54.94	8 8 26 Fe 55.85	9 9 27 Co 58.93	10 10 28 Ni 58.69	11 11 29 Cu 63.55	12 12 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
19 K 39.10	20 Ca 40.08	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,  $N = 6.02 \times 10^{23} \text{ molecules/mole}$

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  $0^\circ\text{C}$  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 Pelil'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 =  $1.008665 \text{ au}$

Proton Mass =  $1.007277 \text{ au}$

1 au =  $931.5 \text{ MeV}$

1 calorie =  $4.184 \text{ Joules (J)}$

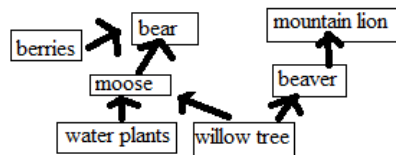
Specific heat of water =  $4.18 \text{ J/g}\cdot^\circ\text{C}$

**2018 – 2019 TMSCA Middle School Science Gear Up Test**

1. What would most likely be the biome of an organism that had the following characteristics?  
thick white fur, large wide feet, keen sense of smell, powerful neck  
A. rainforest            B. prairie            C. tundra            D. taiga
2. Cattle and the cattle egret have a symbiotic relationship. The cattle stir up food for the egrets and the egrets sometimes remove pests from the cows. What type of relationship do they have?  
A. instinctive  
B. parasitism with some commensalism  
C. commensalism with some mutualism  
D. none of these
3. On the pH scale, going from 0 to 1, or from 1 to 2, does what to amount of acidity?  
A. Increases the acidity 10 times  
B. Increases the acidity 100 times  
C. Decreases the acidity 10 times  
D. Decreases the acidity 100 times
4. Complete this analogy: guyots is to ocean as butte is to \_\_\_\_\_.  
A. plains            B. beach            C. rainforest            D. wetland
5. Animals have interesting behavior adaptations. For instance, some snake species, such as the western hognose, will turn upside and burst capillaries in their mouth for what reason?  
A. to help them have a better angle to bite  
B. to scare the predator and warn them to stay away  
C. to become more camouflaged with their surroundings  
D. to trick their predators into thinking that they are dead
6. Just after a first quarter or third quarter moon, what takes place?  
A. spring tides  
B. neap tides  
C. meteor shower  
D. aurora
7. What is the SI unit to measure power?  
A. ampere  
B. watt  
C. hertz  
D. Newton
8. A cockroach was timed as it ran continuously along the edge of a 5-meter kitchen wall. It completed the distance in 4 seconds. What was its average speed?  
A. 20 m/s  
B. 0.8 m/s  
C. 1.25 m/s  
D. 1.5 m/s

9. Which of the following do plant cells use to absorb, store, and use energy?  
A. photosynthesis and respiration  
B. respiration and digestion  
C. fermentation and respiration  
D. condensation and transpiration
10. What does the prefix “ceph” mean?  
A. toes            B. fingers            C. liver            D. head
11. What type of chemical bond is when electrons are transferred from one atom to another?  
A. covalent            B. sessile            C. ionic            D. metallic
12. Which of these is not an organic compound found in animal cells?  
A. lipids            B. carbohydrates            C. nucleic acids            D. water
13. Which list below shows the correct relationship sequence?  
A. organelle; cell; tissue; organ; system; organism  
B. organism; organ; system; tissue; cell; organelle  
C. system; tissue; cell; organ; organelle; organism  
D. cell; tissue; organelle; organ; organism; system

14. This diagram shows the flow of energy in a food web. Which organisms may be in competition for food?



- A. berries and beaver  
B. bear and beaver  
C. mountain lion and moose  
D. beaver and moose
15. Out of the following waves on the electromagnetic spectrum, which has the shortest wavelength?  
A. ultraviolet light  
B. infrared waves  
C. gamma rays  
D. radio waves

16. A class conducted an experiment to test what contaminants could be filtered from water using several different filter types. The chart shows the results.

Filter type	Contaminant 1	Contaminant 2	Contaminant 3	Contaminant 4	Contaminant 5
A	no	yes	no	yes	no
B	yes	yes	yes	yes	no
C	no	yes	yes	no	no

What contaminant was not removed by all three filters?

- A. Contaminant 1
  - B. Contaminant 2
  - C. Contaminant 4
  - D. Contaminant 5
17. Which of the following about the country of Tanzania has the most effect on its climate?
- A. population
  - B. topography and distance from equator
  - C. number of forests located here
  - D. number and size of mountains here
18. The imaginary circle drawn on the celestial sphere in which the sun appears to turn after reaching its greatest declination in the northern hemisphere is called what? (23.5 degrees N latitude)
- A. Tropic of Capricorn
  - B. Equator
  - C. Arctic Circle
  - D. Tropic of Cancer
19. Complete this analogy: gymnosperms is to Mesozoic Era as angiosperms is to \_\_\_\_\_Era.
- A. Cenozoic
  - B. Paleozoic
  - C. Cambrian
  - D. Precambrian
20. The Axolotl is an unusual animal because of which of the following reasons?
- A. It is a reptile with amphibian like characteristics.
  - B. It is a fish that can walk on land.
  - C. It is an amphibian than has amazing regenerative abilities.
  - D. It is a bird that can swim faster than a human.
21. Which of the following processes involve a chemical change occurring?
- A. Dewdrops condensing on a plant in the early morning
  - B. Steam forming over a teapot on the hot stove
  - C. Dry ice “disappearing” after setting on a kitchen counter
  - D. Rust forming on an old bicycle that was left outside

22. In a vascular plant, the tissue that carries water to the cells is called what?
- A. Phloem      B. Xylem      C. Cambium      D. Stomata
23. How is polarized light different from unpolarized light?
- A. Unpolarized light waves vibrates in one horizontal plane and polarized does not.  
B. Polarized light waves means that the light has been lined up with a magnetic field.  
C. Polarized light waves vibrates in one plane and unpolarized light waves vibrates in more than one plane.  
D. Unpolarized light has been filtered to exclude all visible light waves except for one.
24. The chemical processes that occur in living organisms to maintain life are called what?
- A. equilibrium  
B. hormones  
C. mitochondrion  
D. metabolism
25. When comparing a cell to a city, the roads or highways would be what part of the cell?
- A. endoplasmic reticulum  
B. mitochondria  
C. cell membrane  
D. vacuole
26. One crystal structure of a mineral may change to another crystal structure of that same mineral when there are variations in what?
- A. water and climate  
B. elements  
C. temperature or pressure  
D. size and mass
27. Which statement about planet Earth is untrue?
- A. Earth is the only planet with water.  
B. Earth bulges a small amount at the equator.  
C. Earth is about 40,000 km in circumference.  
D. Earth is slightly flattened at its poles.
28. An airplane flight from Dallas/Ft. Worth to New York City may take actual air time of 3.5 hrs. The return trip from New York City to Dallas/Ft Worth would be 4 hrs. What is a reasonable explanation why the return flight takes longer?
- A. From DFW to NYC you are flying west to east which is the opposite way the Earth is rotating which can speed up the air time.  
B. From DFW to NYC you are flying west to east which is the same way that the winds, including the jet stream, blow which makes the flight faster.  
C. The airline from NYC to DFW takes longer to process the flights because of population.  
D. The flight time is the same, it just appears to be different because of time changes.

29. A squid belongs to which phylum listed below?  
 A. Mollusca  
 B. Cnidaria  
 C. Chordata  
 D. Echinodermata
30. Which of the elements below are found in the same period on the Periodic Table?  
 A. Lead and Tin  
 B. Iron and Cobalt  
 C. Calcium and Magnesium  
 D. Lithium and Sodium
31. When calculating specific gravity, a person is making a comparison of what?  
 A. The object's density compared to the density of an equal volume of water.  
 B. The object's density compared to the object's volume.  
 C. The object's mass compared to twice its volume in water.  
 D. The object's volume compared to the mass of the same object.
32. After fanning the thermometers on a psychrometer, Rubin found the dry-bulb thermometer had a reading of 12° C and the wet-bulb thermometer had a reading of 8° C. Rubin was able to find the relative humidity to be what?

- A. 57%  
 B. 19%  
 C. 0 %  
 D. 51%

Dry Bulb Temperature (Celsius)	Difference Between Wet-bulb and Dry-bulb Temperatures (°C)													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
-20	100	28												
-18	100	40												
-16	100	48												
-14	100	55	11											
-12	100	61	23											
-10	100	66	33											
-8	100	71	41	13										
-6	100	73	48	20										
-4	100	77	54	32	11									
-2	100	79	58	37	20	1								
0	100	81	63	45	28	11								
2	100	83	67	51	36	20	6							
4	100	85	70	56	42	27	14							
6	100	86	72	59	46	35	22	10						
8	100	87	74	62	51	39	28	17	6					
10	100	88	76	65	54	43	33	24	13	4				
12	100	88	78	67	57	48	38	28	19	10	2			
14	100	89	79	69	60	50	41	33	25	16	8	1		

33. Decomposers benefit an ecosystem by doing mostly what?  
 A. Filtering out pollutants  
 B. Preventing organisms from becoming too populated  
 C. Returning nutrients to the soil  
 D. Replenishing moisture to the atmosphere

34. Which of the following statements is false when discussing chemical reactions?

- A. The products are the substances that result from the change.
- B. The reactants are the substances that undergo the change.
- C. This symbol  $\rightarrow$  stands for “energy”
- D. Each symbol may have a coefficient if needed.

35. Which of the following belongs in kingdom animalia?

- A. algae
- B. fungus
- C. sponge
- D. phytoplankton

36. Jamie was redecorating and needed to move a grand piano from once side of the room to the other. Jamie applied 100 N of force on the piano to push it to the east side of the room. Her friend pushed with 250 N of force. The piano moved 0 meters. How much work was done on the piano?

- A. 0 J
- B. 100 J
- C. 250 J
- D. 350 J

37.



Sometimes models contain limitations. What is a limitation of using this glucose model?

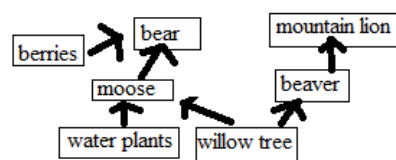
- A. It shows three elements and the number of atoms that make up the molecule.
- B. It only shows 6 atoms of Carbon.
- C. It represents chemical bonds as “sticks” connecting the circular oversized atoms.
- D. It shows which element bonds with what element in the molecule.

38. A door with hinges is an example of what class of lever?

- A. first class – fulcrum is in between effort force and load force
- B. second class – load force is between the effort force and the pivot point
- C. third class – effort force is between the load force and the fulcrum
- D. none of these

39. According to this diagram, what labels would fit the bear?

- A. tertiary consumer and carnivore
- B. primary consumer and secondary consumer
- C. secondary consumer and omnivore
- D. producer and herbivore





40. Many times, paleontologists can learn by the fossilized waste left behind from ancient creatures. What are these specimens called?
- A. impressions
  - B. dendrites
  - C. concretions
  - D. coprolites
41. If a solution has a pH of 6, this means the solution is what?
- A. Slightly basic
  - B. Slightly acidic
  - C. More basic than acidic
  - D. Dangerously acidic, do not touch
42. In a vascular plant, the tissue that carries food to the cells is called what?
- A. phloem
  - B. xylem
  - C. cambium
  - D. stomata
43. Jose had two minerals that were both colorless but couldn't tell them apart. One is calcite and one is halite. What would be a method that would reveal which is which?
- A. Place them both on a streak plate to check the color of their streak.
  - B. Look closely at their color to tell the difference.
  - C. Check to see if they can be picked up by a magnet.
  - D. Taste each mineral (after cleaning each) and determine which one is salty.
44. How did the word "radar" originate?
- A. Named after its two inventors, Raymond and Dartmouth.
  - B. Came from the French word "radiant" meaning to emit rays
  - C. Named from Radio Detection and Ranging
  - D. Named from Latin word for sound
45. During Josie's science project, she kept a journal and recorded observations of the plants she was growing. She wrote down information on the leaves, the color of the leaves, any specific smells emitted, direction of growth, and more. She also measured the height of the plant every day. Which of the following is example of a quantitative observation that Josie made?
- A. height of the plant in cm
  - B. color of the leaves
  - C. smell of the leaves
  - D. direction of growth
46. What does the prefix "hipp" mean as in the word "hippiater"?
- A. fat
  - B. horse
  - C. cool
  - D. old

47. An octopus belongs to which phylum listed below?
- A. Mollusca
  - B. Cnidaria
  - C. Chordata
  - D. Echinodermata
48. The boundary between Earth's crust and mantle was discovered by a Croatian seismologist in 1909. This boundary, named after this scientist, is called what?
- A. Moho
  - B. Lithosphere
  - C. Croviate
  - D. Gambert
49. Which of the following lists are all mammals?
- A. ant, lizard, turtle, bird
  - B. koala, beaver, tiger, emu
  - C. manatee, dolphin, armadillo, cat
  - D. kangaroo, platypus, manta ray, shark
50. Hiran and Jayesh were playing tug of war with a rope. Hiran pulled on the rope with a force of 50 N south. Jayesh pulled on the rope with a force of 63 N north. Who won the game and what was the net force?
- A. Hiran 13 N south
  - B. Hiran 113 N south
  - C. Jayesh 13 N north
  - D. Jayesh 113 N north

**2018 - 2019 TMSCA Middle School Science Gear Up Test - Key**

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