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   # 7 ©
J A N U A R Y   1 8 ,   2 0 2 0

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^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, $N = 6.02 \times 10^{23}$ 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 al 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 x 10^4 C)

Dulong and Pelil's constant= 6.0 amu•cal/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 on electron"' -1.6×10^{-19} coulombs (C)

1 horsepower (hp) = 746 W = 550 ft•lb/s

Neutron Moss= 1.008665 au

Proton Mass= 1.007277 au

1 au= 931.5 MeV

1 calorie= 4.184 Joules (J)

Specific heal of water= 4.18 J/g• °C

1. In the past, people would throw their food scraps and yard wastes in vacant fields to let them decompose. Now, there are fewer vacant fields and this practice is longer allowed. Which of the following is a more environmentally friendly and acceptable way of disposing of these items?
   A. hide them in a nearby ditch on an old road
   B. place them in a compost pile
   C. place them in the trash which then goes to a landfill
   D. burn them in a brush pile

2. Jasmine's teacher passed out light sticks to her class. The light stick contains two chemicals that are separate. When the stick is snapped, the part that separates the chemicals opens up and allows the chemicals to mix which gives off light energy. What type of change does this show?
   A. physical change
   B. chemical change
   C. matter exchange
   D. light and matter change

3. Which muscle described below is considered smooth muscle?
   A. muscles that make your fingers move
   B. muscles inside the walls of blood vessels
   C. skeletal muscles
   D. cardiac muscle

4. How many neutrons are there in a neutral atom of iron?
   A. 8   B. 26   C. 52   D. 30

5. Clues: born in England in 1900, discovered that the sun is mostly hydrogen, as well as most of the universe, the first woman promoted to professor at Harvard University
   Who is this person?
   A. Rosalind Franklin
   B. Marie Curie
   C. Katherine Johnson
   D. Cecilia Payne-Gaposchkin

6. Which definition below would be the best to describe technology?
   A. anything that uses electricity
   B. computers that make tasks easier
   C. a process or object that has been designed to be useful to people
   D. an object that has designed to move something or do work

7. All of the substances in this chart were carefully poured or placed in a tall beaker that will hold 250 mL and allowed to settle out. What would be the correct order of layers from bottom of the beaker to the top?

Substance	Density	Volume
Ping Pong ball	0.0840g/cm^3	33.5 mL
Glycerin	1.260 g/cm^3	40 mL
Corn oil	0.91 g/cm^3	40 mL
Rubbing alcohol	0.791 g/cm^3	40 mL
Penny	8.0 g/cm^3	0.35 mL
Corn syrup	1.360 g/cm^3	40 ml

    A. ping pong ball, rubbing alcohol, corn oil, glycerin, corn syrup, penny
    B. penny, rubbing alcohol, glycerin, corn syrup, corn oil, ping pong ball
    C. ping pong ball, penny, corn syrup, glycerin, rubbing alcohol, corn oil
    D. penny, corn syrup, glycerin, corn oil, rubbing alcohol, ping pong ball

8. Students in Mr. Miller's class were testing out different methods of compost piles. They used three upside down bottles that were cut open. In Bottle 1, they placed a layer of dirt, layer of food and paper scraps, and another layer of dirt. In Bottle 2, they placed a layer of dirt, layer of food and paper scraps, tablespoon of yeast and water mixture, and another layer of dirt. In Bottle 3, they placed a layer of dirt, layer of food and paper scraps, four or five redworms, and another layer of dirt. All three bottles were placed in a box with same sunlight exposure and the dirt used in each container was from same source.

What could be a reasonable hypothesis for this experiment?
    A. The extra dirt layer will increase decomposition of the scraps.
    B. The yeast and water mixture will increase decomposition of the scraps.
    C. The food and paper scraps will decompose best if placed in a dark area.
    D. The worms will escape which will decrease decomposition.

9. What would be the independent variable in the experiment above?
    A. the amount of sunlight that each pile receives
    B. the type of dirt used in the experiment
    C. the arrangement of the dirt in the layers
    D. the method of decomposition, items added to compost pile

10. What would be the dependent variable in the experiment above?
    A. the number of worms that are used
    B. the number of bottles that are used in the experiment
    C. the type of food in the scraps
    D. the amount of decomposition that takes place

11. What would be considered the control in the experiment above?
    A. the source of the dirt   B. Bottle 1   C. Both B and D   D. Bottle 3

12. Which of the following is not considered a simple machine?
    A. inclined plane B. trebuchet   C. lever   D. wheel and axle
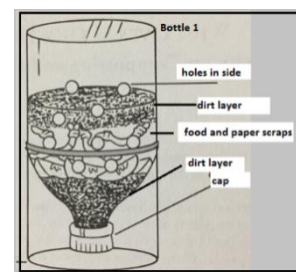
13. Which seed type below is considered to be a "drupe"?

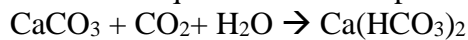| A.	B.	C.	D.
Sweetgum	Oak	Bald Cypress	Hackberry

14. Which of the following shows the correct order from large to small of the levels of organization?
   A. biosphere, biome, community, ecosystem, population, organism
   B. biome, biosphere, population, community, ecosystem, organism
   C. biosphere, biome, ecosystem, community, population, organism
   D. biome, ecosystem, biosphere, community, population, organism

15. The chemical equation below helps to explain what?
   $CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$
   A. the formation of substance in fire extinguishers
   B. the formation of stalactites and stalagmites
   C. the formation of table salt
   D. the formation of a volcanic eruption
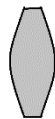
16. Which of the following is not a hydrocarbon?
   A. Silane   B. C_3H_8 C. Methane   D. Butane

17. If an optometrist wants to correct a person's vision who has myopia, what type of lens would work best?
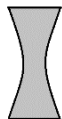
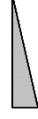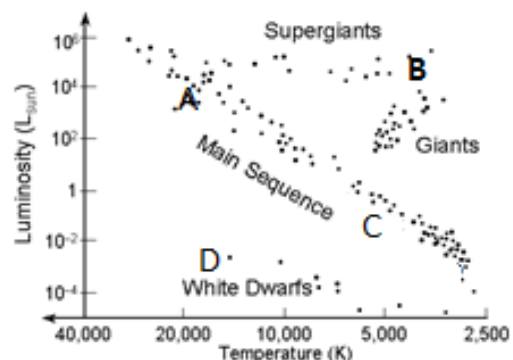   A.   B.   C.   D.

18. What type of bridge involves using a flat piece that is laid across two or more supports or piers?
   A. arch   B. suspension   C. beam   D. abutment

19. Using this H-R Diagram,which letter would most likely show the placement of the star, Betelgeuse? (a red supergiant)
   A.   B.   C.   D.

20. As you look at a cell under a microscope, what would be best to look for to decide if it was a plant cell, an animal cell, or bacteria?
    A. a cell wall, large vacuole, and chloroplasts
    B. a nucleus, a cell membrane, and cell wall
    C. absence of a cell wall, mitochondria, and mitosis
    D. absence of a nucleus, a cell membrane, and vacuoles

21. This graph shows the temperature and amount of water vapor in the air accordingly. If the air temperature is 50 deg. C, about how much water vapor would there be in ten cubic meters of air?
    A. 80g
    B. 40 g
    C. 30 g
    D. 800 g

Temperature Effects on Water Vapor Amounts
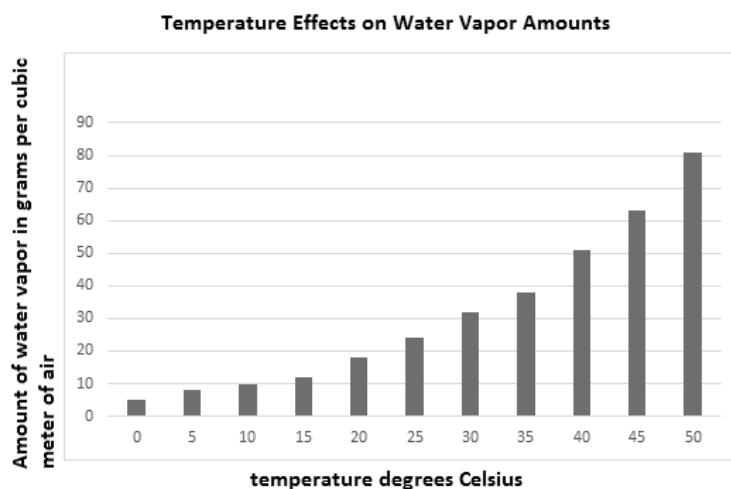
22. What is considered a homogeneous mixture of two or more substances in a single phase?
    A. compound   B. element   C. colloid   D. solution

23. Maximillian sunflowers have a rhizomatous root system and will return each year. What type of plant is this?
    A. annuals
    B. perennials
    C. biennials
    D. none of these

24. Around the Indian Ocean and South Pacific Ocean area, what we call a "hurricane" would be called what instead?
    A. typhoon   B. also, a hurricane   C. depression   D. tropical cyclone

25. In an experiment, a small amount of sulfur with a density of 2.1 g/cm^3 is placed on the top surface of water in a clear glass. Even though the density of the sulfur is higher than water, the sulfur stays afloat. Why does this happen?
    A. the surface tension of the water
    B. the water chemically reacts with the sulfur
    C. water density is actually higher than the sulfur's density
    D. magical science mystery

26. According to base-paring rules, the sequence of nitrogen bases on one strand of DNA being ACCTTGT will only pair with which sequence on the other strand?
    A. TGGAACA
    B. TGCAUCA
    C. ACCTTGT
    D. UGGAACA

27. Tetherball is a playground game that involves a ball hanging from a rope on a pole. During the game, a player will start the ball in motion which will continue until the opposing player stops the ball and starts it in the opposite direction. The player, who gets the ball to wrap all around the pole in the direction that they push the ball, wins the game. What would be a variable(s) that could cause variations in forces used in this game?
    A. mass of ball
    B. length of rope
    C. color of ball
    D. both A and B

28. What microscope out of the following has the highest magnification factor?
    A. compound light microscope
    B. stereomicroscope
    C. atomic force microscope
    D. transmission electron microscope

29. The school's academic team won a sweepstakes trophy and set it firmly on a shelf in their classroom. The trophy on the shelf is in what state?
    A. state of dynamic equilibrium
    B. state of static equilibrium
    C. no state of equilibrium
    D. state of unbalanced forces

30. Which of the following statements does not support the idea that light travels faster than sound?
    A. you hear thunder after you see the lightning
    B. you see a baseball fly before you hear the crack of the bat hitting the ball
    C. you hear the fireworks explode and then see the different colored lights
    D. you see the eruption of a volcano before you hear the eruption

31. Which of the following compounds and formulas are correctly matched?
    A. C_2H_6O -Methane, CH_4 -Propane, C_3H_4 - Ethanol
    B. CH_4 – Propane, C_2H_6O – Methane, C_3H_4 - Ethanol
    C. C_2H_6O – Propane, C_3H_4 - Ethanol CH_4 - Methane
    D. CH_4 – Methane, C_3H_4 – Propane, C_2H_6O – Ethanol

32. Which of these types of organisms are considered to be "warm blooded"?
    A. endotherms   B. ectotherms   C. isotherms   D. biotherms

33. What should civil engineers do to design safe and stable structures for people to use?
    A. apply forces in the opposite direction of forces that compromise the strength or stability of a structure
    B. apply forces in the same direction of forces that compromise the strength and stability of a structure
    C. apply forces on a structure that are only balanced when the structure is straight, level, or even
    D. civil engineers do not deal with forces

34. Bats navigate in the dark through a special process called echolocation. During this process, bats do what?
    A. emit sound waves by rubbing special structures on their feet together and then the waves return to their ears
    B. send out sound waves through their mouth or nose that bounce off the object to return to their ears
    C. bend sound waves with a special device found in their unusual ear shapes
    D. have special sound collection devices which use the sounds from prey to locate them

35. Which of the following statements about shrews is not true?
    A. Shrews are mostly insectivores
    B. Shrews are strictly diurnal
    C. Shrews have high metabolic rates
    D. Shrews can be found on 5 continents

36. Clues: born in Germany in 1857, first person to send and receive radio waves, unit of frequency was named after him   Who is this person?
    A. Michael Faraday   B. Alessandro Volta   C. Nikola Tesla   D. Heinrich Hertz

37. The condition of the atmosphere at a given place and time is called what?
    A. weather   B. climate   C. meteorology   D. temperature

38. Most tanks for recreational scuba diving are filled with what?
    A. pure oxygen
    B. compressed air that has been filtered and dehumidified
    C. Nitrox
    D. Trimix

39. Most of the mass of an atom is in the what?
    A. electrons   B. energy levels   C. subatomic particles   D. nucleus

40. Matter has chemical and physical properties. Malcolm made a list of all the physical properties he could remember. Is his list correct? Why or why not?

Physical Properties of Matter
Solubility
Melting point
Boiling point
Malleability
Flammability
Density
Electrical Conductivity
Ductility

    A. Yes, these are all physical properties of matter.
    B. No, flammability is a chemical property.
    C. No, ductility is a chemical property.
    D. No, electrical conductivity is a chemical property.

41. Clues: plant type, seedless, almost all have vascular tissue, includes ferns
    What plant type is this?
    A. gymnosperm   B. angiosperm   C. bryophytes   D. pteridophytes

42. Rohan was comparing two substances to determine if they were metals or non-metals.
    Substance A – shiny, high density, malleable, conductor
    Substance B – dull, low density, brittle, insulator
    Which conclusion below would be correct?
    A. Substance A is a metal and Substance B is a non-metal.
    B. Substance A and B are both metals.
    C. Substance A and B are both non-metals.
    D. Substance A is a non-metal and Substance B is a metal.

43. Students in Mrs. Nix's classroom measured the area of the room. Then they counted the number of humans present in the class. They divided the area by the number of humans and came up with a number. This number would be the what?
    A. population density of the class
    B. carrying capacity of the classroom
    C. limiting factor of the classroom
   D. biotic potential of the classroom

44. Joe wanted to stop for fast food with his friend Sam.
He started off on his bike at his house and rode to Sam's house.
Next, both Sam and Joe rode to the Fast Food place, but decided
to pass by Pizza Parlor and grocery store first. After stopping
at Fast Food, they both went to Joe's. What was Joe and Sam's
displacement?
    A. 12.05 km for both
    B. Joe – 0 km and Sam – 1.3 km
    C. Joe 12.05 km and Sam – 10.75 km
    D. 1.3 km for both
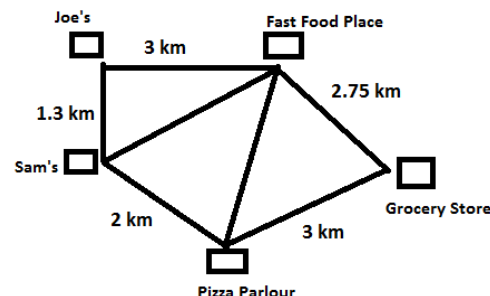
45. A shield volcano such as Mauna Loa is produced by the accumulation of what?
    A. pyroclastic fragments
    B. embedded cinders and ash in andesitic lava
    C. dacite/rhyolite type
    D. fluid basaltic lava

46. A volcanologist was walking across a cooled area of a lava flow. The rubbly surface was difficult to walk across because of the broken lava blocks called "clinkers". What type of lava most likely formed this?
    A. Pahoehoe   B. Blocky   C. Pyroclastic   D. ʻAʻā

47. What is the acceleration of gravity at the Earth's surface?
    A. 1.62 m/s^2 B. 9.81 m/s^2 C. 8.87 m/s^2 D. 3.711 m/s^2

48. Which of the following statements about minerals is not true?
    A. the most common mineral on Earth is quartz
    B. minerals are ranked on a hardness scale
    C. they are highly soluble in water
    D. they are considered inorganic

49. Which of the following would be a reasonable mass of an average adult human being?
    A. 226 kg   B. 6,780 grams   C. 6,780 ounces   D. 59 kg

50. During an experiment, Joseph needed to measure out 10 mL of liquid. There was already some of the liquid in the graduated cylinder (as shown in the photo below). Reading the meniscus correctly with the liquid in this cylinder, how much more liquid should Joseph add?
    A. 3 mL
    B. 7 mL
    C. 8 mL
    D. 10 mL
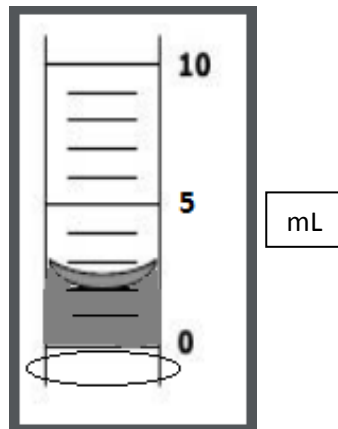
2019 - 2020 TMSCA Middle School Science Test #7 - Key

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