TMSCA MIDDLE SCHOOL

SCIENCE

TEST #1©

OCTOBER 22, 2022

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.

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 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 x 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. In science class, students took an iron nail and "plated" it with copper by using old pennies. This activity included using vinegar, salt, and a specific set of directions. Some copper from the pennies became part of the vinegar and salt solution. When the iron nail was added to the solution, the nail changed to a copper color and bubbles were observed. Which statement below is true about this activity?
A. A physical change happened because the color left the copper and was added to the nail.
B. A physical change happened because the iron in the nail did not change at all.
C. No chemical or physical change took place with this activity.
D. A chemical reaction took place with the elements used.

2. Janice wanted to make musical instruments out of a set of 4 glass bottles. She lined them up in a row and added water in different amounts to each of the bottles as shown. To make a sound, she blew across the top of the bottles. Out of these bottles, which bottle produced the highest note?
A. 1
B. 2
C. 3
D. 4

3. Daryl dissolved 50 mg of salt in 1 liter of water. Which is the solute in this event?
A. salt
B. the amount of time spent stirring
C. the container the solution is in
D. water

4. Which of the following is a metalloid?
A. Silicon   B. Arsenic   C. Carbon   D. Both A and B

5. To calculate average velocity, you need to know what two things?
A. displacement and density
B. mass of object and time
C. volume and space
D. change in position and time

6. What is the average speed of a car travelling 60 miles in 60 minutes?
A. 60 miles per hour
B. 1 mile per minute
C. 120 miles per hour
D. Both A and B are correct

7. The prefix "pter" has to do with what?
A. having wings or fins   B. being in the middle   C. tall or lankly   D. green or shades of green

8. Cooking a cheeseburger is what type of change?
A. physical
B. chemical
C. both physical and chemical
D. neither physical or chemical

9. The diagram shown here was seen on
the wall in a doctor office. What type
of doctor would most likely use this diagram?
A. urologist
B. otolaryngologists
C. geneticist
D. dermatologist
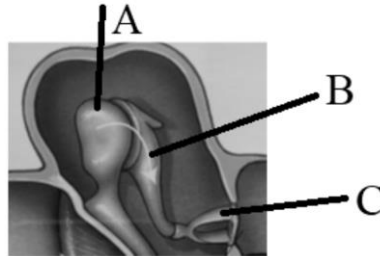
10. An earthquake took place on a coastal land mass. The earthquake triggered a landslide that fell into the ocean beside the land mass. A huge wave began that crossed the bay and continued until it crashed into the opposite shore of the bay. What is the name given to this type of wave?
A. tsunami   B. derecho   C. rogue   D. perm

11. This man, despite being enslaved at birth, became a noted scientist who created over 300 uses for peanuts and was an educator at Tuskegee Institute. Who was he?
A. Percy Julian
B. Benjamin Banneker
C. Charles Henry Turner
D. George Washington Carver

12. Which of these animals is known for being a "keystone" species that can control its environment and create an ecosystem for other animals to live in?
A. skunk   B. beaver   C. raccoon   D. duck

13. What scale is used when measuring pH?
A. 1-10   B. 0-14   C. 1 to 5   D. 0 to 100

14. The word "gibbous" comes from a Latin word that means what?
A. tall like a tower
B. flat like a pancake
C. large like a monster
D. humped like a camel

15. A chemical element that is the physical basis of life on Earth is what?
A. silica   B. carbon   C. hydrogen   D. krypton

16. Which of the following rocks will float in water? (density listed beside name)
A. granite 2.7   B. marble 2.7   C. limestone 2.0   D. pumice 0.5

17. An ammeter is an instrument used for the measurement of what?
A. wind   B. electric current   C. magnitude   D. drag

18. Water in its gaseous state is called what?
A. water vapor   B. fog   C. ice   D. Both A and B

19. The force that propels an aerospace vehicle or a marine craft is called what?
A. gravity   B. drag   C. thrust   D. momentum

20. Non-native grasses can be invasive and use resources that native grasses need to grow. To find out more about why these non-native grasses grow, a group of students recently investigated the effect of artificial light on the growth of one species of non-native grass. They found alleys behind homes that had artificial streetlights on at night and alleys that didn't have any lights on at night. Next, they counted the number of non-native plants in these sites. What would be the independent variable for their investigation?
A. the number of plants counted in the sites
B. whether the sites had artificial lights or no artificial lights
C. whether the grass was native or non-native species
D. how many lights that there were at each site

21. What do these words have in common?
cochlea, stapes, malleus, incus
A. They help with digestion.
B. They help with respiration.
C. They help with tasting flavors.
D. They help with hearing sounds.

22. In a coral reef, coral provides protection for the zooxanthellae that lives on its surface. The algae, zooxanthellae, then provide nutrients for the coral. What type of relationship do they have?
A. mutualism   B. parasitism   C. commensalism   D. botulism

23. Coral reefs are composed of the coral "skeletons' of these animals that is composed of what?
A. granite deposits
B. $CaCO_3$
C. calcium carbonate
D. Both B and C

24. Jeff wanted to see how far away he could go and still hear the music from the concert. He began walking until he couldn't hear the music anymore. If it was a cold day, would he hear the music farther away or closer than he would on a warm day?
A. He would hear the music farther away on a warm day than on a cold day.
B. It wouldn't make any difference what the temperature was, the distance would be the same.
C. The music could not be heard farther than 100 meters.
D. He would hear the music farther away on a cold day than on a warm day.

25. What does the prefix "macro" mean?
A. large	B. small	C. same	D. shape

26. How many atoms make up this compound? $CaCO_3$
A. 4	B. 5	C. 3	D. 6

27. Timothy's experiment required using a wave with a long wavelength. What should he use?
A. ultraviolet light	B. infrared wave	C. gamma waves	D. radio waves

28. Which of the following is an important measurement used when forecasting severe storms?
A. wind sheer
B. dewpoint
C. amount of moisture in air
D. All of these

29. How long does is take the moon to rotate once on its axis?
A. 24 hours	B. 27.3 days	C. 12 days	D. 365 days

30. A gemstone that is a form of hydrated silica that does not form as a crystal is which of these?
A. diamond	B. opal	C. garnet	D. pearl

31. Which of these minerals are considered fluorescent?
A. sodalite	B. apatite	C. zircon	D. all of these

32. The science teacher took a "slinky" and demonstrated a wave movement by moving the slinky up and down. The displacement of the wave is at right angles to the direction of the wave. What type of wave was the teacher demonstrating?
A. longitudinal wave
B. centripetal wave
C. amplitude wave
D. transverse wave

33. What term is used in geology for the carrying away of sediments to a new location?
A. weathering	B. erosion	C. mass wasting	D. cementation

34. Which of the following statements is true about planet orbits in our solar system?
A. Each of the planets orbit the sun at the same speed.
B. The planets orbit the sun in a perfect circular path.
C. Each planet's speed changes as it orbits closer to the sun and slows as it moves further away.
D. Each planet's orbit around the sun causes the seasons.

35. The word "posterior" when used in anatomy class describes what part of the object?
A. front	B. side	C. rear	D. top

36. What do all these animals have in common?   coyote, fox, dog, wolf
A. They are all bipeds.
B. They are all canids.
C. They all should have 42 teeth.
D. Both B and C.

37. A type of test involving a biochemical process that produces repeated copies of a particular DNA sequence and can be used to test for viruses is called what?
A. PCR   B. CDC   C. WBC   D. ABC

38. A fatty material travels through blood in vessels called lipoproteins. Too much of this can cause problems with blood vessels and the heart. What is it?
A. platelets   B. hemoglobin   C. cholesterol   D. hormones

39. Eukaryote or Prokaryote?   amoeba, E. coli, and people
A. amoeba – eukaryote   E. coli – prokaryote   people - prokaryote
B. amoeba – eukaryote   E. coli – eukaryote   people - eukaryote
C. amoeba – eukaryote   E. coli – prokaryote   people – eukaryote
D. amoeba – prokaryote   E. coli – prokaryote   people – eukaryote

40. About how much of the Earth's water is considered available for human use?
A. about 50%   B. 97%   C. 3%   D. <1 %

41. How many valence electrons does a Carbon atom contain?
A. 4   B. 8   C. 6   D. 0

42. A curved lattice grid structure that utilizes an equilateral triangle as the basis of its surface grid geometry is called what?
A. ribbed dome   B. geodesic dome   C. lamella dome   D. all of these

43. The flow of thermal energy through a solid from a higher to lower temperature region is called what?
A. heat convection   B. heat conduction   C. heat conversion   D. heat shear

44. The diagram below the results of a cross between two plants. T- is the symbol for tall trait and t- is the symbol for dwarf trait.
What would be the genotype of the plants that were crossed?
A. top tt, side tt
B. top Tt, side tt
C. top TT, side tt
D. top TT, side TT

|	?	?
?	Tt	tt
?	Tt	tt
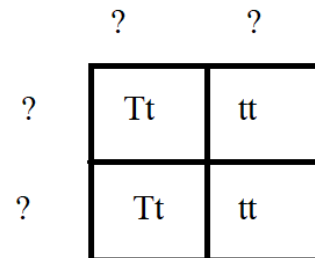
45. Using the above diagram, what would be the genotypic ratio for the offspring of this cross?
A. 1 Tt: 1 tt   B. 3 Tt: 1 tt   C. 1 Tt: 3 tt   D. 2 TT: 1 tt

46. Bees, ants, and wasps belong to what order?
A. Coleoptera   B. Lepidoptera   C. Diptera   D. Hymenoptera

47. Most insects of the Order Coleoptera have which of the following characteristics?
A. chewing mouthparts
B. undergo complete metamorphosis
C. have two pairs of wings – one hardened pair, and one membranous pair
D. All of these

48. Jose was making a model for a school project. He mixed Epsom salt with water, a little bit at a time, until he could not dissolve any more in the solution. Next, he set up two jars and filled them with the Epsom salt solution. Finally, he tied a washer on both ends of a cotton string and placed it between the cups as shown in the diagram.
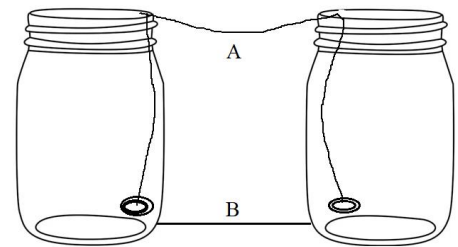
What statement below will be true about his project?
A. Over time, minerals will begin to deposit in Area B forming
a model of a stalactite in that spot.
B. Over time, minerals will begin to drip down around
Area A forming a model of a stalagmite in that spot.
C. Over time, nothing will form because Epsom salt will
destroy the string.
D. Over time, minerals will travel along the string and drip from point A, forming
a model of a stalactite at point A and a model of a stalagmite at point B.

49. What would be the best title for Jose's school project shown above?
A. Volcanology Structures
B. Alluvium Structures Investigation
C. Modelling Karst Structures
D. Minerology Models

50. Thermometer is to temperature as hygrometer is to what?
A. dewpoint
B. wind speed
C. pressure
D. humidity

2022 - 2023 TMSCA Middle School Science #1 Test - Key

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