TMSCA MIDDLE SCHOOL SCIENCE STATE MEET ©

APRIL 16, 2016

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												3A	4A	5A	6A	7A	8A
1 H 1.008	2A						8B			1B	2B						2 He 4.003
3 Li 6.941	4 Be 9.012											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 23.00	12 Mg 24.31	3B	4B	5B	6B	7B						13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	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 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)		109 Une (267)									

Lanthanides	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
Actinides	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	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 (260)

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, $\hbar \equiv {}^{h}/_{2\pi} = 1.05 \times 10^{-34}$ J•s

Standard temperature and pressure (STP) is 0°C and 1 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 cal/K•mole = 0.082 liter•atm/K•mole

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

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

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

Atomic mass unit, $m_a = 1.66 \times 10^{-27}$ kg

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

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

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

1 Atmosphere = $1.02 \times 10^{5}\ N/m^2$ = 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

2015-2016 TMSCA Middle School Science State Championship

1. A group of cells that receives messages about the body's oxygen needs and sends out signals to adjust the heart rate is called the _____.
   A. atrium B. lymph node C. valve D. pacemaker

2. In the Southern Hemisphere, surface currents flow in a/an _____ direction.
   A. north-south B. clockwise C. up-and-down D. counterclockwise

3. The part of your brain that connects to your spinal cord is the _____.
   A. pituitary B. medulla C. cerebellum D. cerebrum

4. Smoke is dark in color because it consists mainly of _____.
   A. CO_2 B. dust C. water vapor D. carbon

5. _____ is the mass, in grams to the nearest whole number, of one cubic centimeter of pure water at standard temperature and pressure.
   A. 0 B. 1 C. 2 D. 10

6. A mid-ocean ridge is an example of a _____ boundary.
   A. divergent B. convergent C. transform D. oceanic

7. The cells of fungi have a ____ made of a chemical similar to that found in the hard covering of insects.
   A. cell membrane B. cell wall C. nucleus D. cytoplasm

8. An ax, a zipper, and a front tooth are examples of a simple machine called a _____.
   A. lever B. screw C. wedge D. pulley

9. Lines on a map connecting points that have the same air pressure are _____.
   A. millibars B. isobars C. isotherms D. front lines

10. Watersheds that supply runoff to different drainage systems are usually separated by a ridge of land called a/an _____.
    A. tributary B. aquifer C. geyser D. divide

11. A mixture that doesn't dissolve, but doesn't settle out is called a/an _____.
    A. solution B. solvent C. colloid D. suspension

12. Slate is _____ rock.
    A. nonfoliated metamorphic C. intrusive igneous
    B. clastic sedimentary D. fine-grained, foliated metamorphic

13. The part of a cell through which charges enter or exit is the _____.
    A. electrode B. electrolyte C. electrolytic converter D. electrolytic inverter

14. Choose the answer that best completes this sentence. Alkali metals _____.
    A. are unreactive C. are Group 1 elements
    B. should be stored in water D. are generally found in their uncombined form

15. Air in the Northern Hemisphere that is rising and moving counterclockwise is generally in the center of a _____.
A. high B. cyclone C. pressure belt D. chinook

16. The movement of rock particles by wind, water, ice or gravity is called _____.
A. erosion B. weathering C. abrasion D. drought

17. The pitcher on the other team has _____ down, the curved path traveled by a thrown baseball. His curveball is making us all strike out.
A. orbiting C. centripetal force
B. velocity D. projectile motion

18. Plants sense stimuli using _____ inside their cells.
A. light B. gravity C. chemicals D. touch

19. When all the molecules of a compound break apart in water to produce hydrogen ions, the compound is considered to be a _____.
A. weak base B. strong base C. a strong acid D. a weak acid .

20. The side of a mountain that faces away from the prevailing wind is called _____.
A. climate B. tropical C. leeward D. microclimate

21. The _____ biome is found below the low –tide line and above the continental shelf.
A. estuary C. surface zone
B. neritic zone D. rocky intertidal zone

22. A chemical reaction between an acid and a base _____.
A. is called neutralization C. can only occur with metals
B. is impossible D. can only occur with nonmetals

23. A rock containing iron becomes soft and crumbly and reddish-brown. It probably has been chemically weathered by _____.
A. living organisms C. carbon dioxide
B. oxygen D. acid rain

24. A device that uses electrical energy to do work is called a _____.
A. circuit B. parallel circuit C. series circuit D. load

25. An organism's specific environment, which provides the things the organism needs, is called its ____.
A. food web B. ecosystem C. habitat D. food chain

26. A necessary component of active transport is _____.
A. water B. concentration C. transport proteins D. autotrophs

27. Wavelengths that are a little bit shorter than visible light are _____.
A. infrared B. red C. violet D. ultraviolet

28. _____ waves can be created by pushing a spring back and forth.
A. Electromagnetic B. Transverse C. Longitudinal D. Micro-

29. The organelle that processes, packages, and transports materials out of a eukaryotic cell is the _____.
A. ribosome B. nucleus C. chloroplast D. Golgi complex

30. A _____ object has more inertia than a 20 kg object.
A. 0.2 kg B. 5 kg C. 2 kg D. 30 kg

31. Estivation is a period of reduced activity in the _____.
A. spring B. fall C. winter D. summer

32. The semicircular canals help you to _____.
A. maintain balance B. hear C. see D. smell

33. P waves _____.
A. travel faster than S waves C. are transverse waves
B. are also called surface waves D. originate at the epicenter

34. _____ energy is involved when a river moves sediment and erodes it banks.
A. Chemical B. Ground C. Potential D. Kinetic

35. Blood is squeezed into _____ when the atria contract.
A. arteries B. ventricles C. veins D. capillaries

36. The scientist, _____ discovered that all elements are made of atoms and atoms of different element are different.
A. Democritus B. Thomson C. Bohr D. Dalton

37. On December 21, what season is beginning in the Southern Hemisphere?
A. winter B. spring C. autumn D. summer

38. During the period between a new moon and a full moon, the moon is described as _____.
A. gibbous B. waxing C. eclipsed D. waning

39. The major organs of the excretory system are the _____.
A. ureters B. lungs C. kidneys D. alveoli

40. Which of these structures help birds get enough oxygen?
A. air sacs B. feathers C. gizzards D. bones

41. Of the following, _____ does not vary with mass of a substance.
A. heat B. energy C. thermal energy D. temperature

42. Fossil fuels are energy-rich because they contain _____.
A. fossil fragments B. heat C. electricity D. hydrocarbons

43. The first part of an organism's scientific name is its classification group called _____.
A. kingdom B. genus C. family D. species

44. The moon's average density is _____.
A. twice as much as Earth's
B. three times as much as Earth's
C. less than Earth's
D. about the same as Earth's outer core

45. _____ best describes how a sedimentary rock can form.
A. Compaction and cementation
B. Fast cooling and hardening of magma
C. Slow cooling and hardening of magma
D. High temperature and pressure causing recrystalization

46. There are _____ atoms of oxygen in $Al_2(SO_4)_3$.
A. 7 B. 12 C. 15 D. 4

47. Scoria and obsidian are two kinds of _____ rocks.
A. sedimentary B. metamorphic C. minerals D. igneous

48. _____ plowing is the practice of plowing fields along the curves of a slope.
A. Abrasion B. Contour C. Conservation D. Horizon

49. Special neuron called _____ send impulses from the brain and spinal cord to other systems.
A. sensory neurons
B. motor neurons
C. axons
D. receptors

50. The mating of animals in zoos or wildlife preserves is called _____.
A. captive breeding
B. poaching
C. habitat preservation
D. gene diversity

2015-2016 Middle School Science State Championship
Answer Key

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